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PENETRATING WOUNDS OF THE EYEBALL—HISTOLOGICAL AND BACTERIOLOGICAL RESEARCHES AND CONSIDERATIONS REGARDING THE PATHOGENESIS OF SYMPATHETIC OPHTHALMIA.

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(*With six drawings, two in the text, and four on a plate at the end of the paper.*)

THE following paper is based on the examination of thirty eyes. The investigations were conducted both with regard to the pathological lesions present and to their etiological factor considered from a bacteriological standpoint. In the first eleven cases, which were old, only a histological examination was made, the next fourteen were studied both from histological and bacteriological points of view, the remaining five bacteriologically.

HISTOLOGICAL CONSIDERATIONS.

The lesions met with in penetrating wounds of the eyeball vary greatly, depending on the structures directly involved, on the nature of the subsequent inflammation, and on the presence or absence of a foreign body.

We find perforating wounds of the cornea, with and without incarceration, prolapse or other injury of the iris, with and without injury to the lens, with and without penetration into the vitreous. The wound may be situated in the sclerotic, in the ciliary region, and then we may have incarceration or prolapse of the choroid and ciliary body, possibly even of the retina. The traumatism may be still

further complicated by large extravasations of blood into the substance of the different structures or into the spaces between them, bringing about an unnatural separation of the parts. These hemorrhages may be due either to a direct injury or to the accompanying contusion. Out of the thirty eyes examined histologically, in twenty-five the wound was situated in the cornea, in six of them at the sclero-corneal margin; the lens was injured in ten cases and had escaped in nine others; the iris had prolapsed in twelve cases, the ciliary body in two. There were six cases of scleral wounds (one, Case 10, presenting both a corneal and a scleral wound); they are all situated immediately behind the ciliary body; in only one case did the ciliary body and choroid prolapse. With regard to the hemorrhagic extravasations complicating the traumatism, there were three cases, Cases 2 and 3, where the enucleation was made in the first days after the injury and where there were only slight inflammatory changes, and Case 9, where the enucleation was made somewhat later and these changes were already marked. In Cases 2 and 9 the posterior extremity of the ciliary body and the anterior portion of the choroid were detached from the sclerotic by the extravasated blood; in Case 3 the retina was detached from the choroid, and the choroid from the sclerotic; in Case 9 there was, moreover, an extravasation of blood into the intervaginal space of the optic nerve.

The condition of the wounds and scars and of the prolapsed and injured structures will be found described in detail in the reports of the cases. Special attention is called to Cases 1 and 6, in each of which there is an organized band of fibrous tissue passing back from the corneal scar, *through the lens*, into the vitreous; to Case 18, where a defect in the cornea and lens is filled by densely infiltrated and escaping vitreous; to Cases 9 and 15, where the ciliary body is fastened in a corneal wound, whereas in Case 23 it is incarcerated in a scleral wound.

NATURE OF THE INFLAMMATION.

The nature of the changes found depends in a great measure on the time which had elapsed from the injury to

the enucleation. Thus we find that a very few of the eyes with severe and destructive injuries had been enucleated before any marked inflammation had set in. See Cases 2 and 3, with large intra-ocular extravasations of blood, where there was only slight inflammation, but quite distinct changes in the optic-nerve sheath; Case 19, where there was a perforating wound of the cornea with prolapse of iris and lens capsule, the lens proper having escaped; and Case 10, where the eyeball was enucleated after an ineffectual attempt to extract a foreign body lodged in the vitreous.

Four of the twenty-five eyes examined histologically were enucleated for an incipient panophthalmitis. In those the lesions consisted in an intense purulent infiltration of all the tissues of the eye especially of the uveal tract, dense deposits of pus cells on both surfaces of the iris, on the ciliary processes, and the retina; both chambers and the vitreous were, as a rule, nothing but one mass of lymphoid cells. In all these cases there was cellular infiltration of the optic nerve and its sheath. (See Cases 4, 15, 18, and 25.)

We come now to the most numerous as well as to the most important group of cases, as regards the greater danger of sympathetic ophthalmia—the irido-cyclitides. Sixteen out of the twenty-five eyes examined histologically belong to this group. They can be divided into three classes: (1) recent cases —where no organization of the exudation has as yet taken place; (2) cases of fully developed, chronic irido-cyclitis with the formation of new connective tissue in the shape of cyclitic bands and membranes; (3) a later stage—phthisis bulbi.

In the first stage we find, apart from the lesion directly due to the traumatism, a general lymphoid infiltration of the uveal tract chiefly in its anterior portions, a more or less abundant cellular deposit on the surfaces of the iris and ciliary processes; there may or may not be an infiltration of the optic nerve or its sheath. See Cases 12, 14, 20, 21, and 23. In Cases 12 and 23 only, was there infiltration of the optic nerve.

In the second stage we have the most important and characteristic lesions. We have to differentiate the cases where

the lens is injured or has escaped, or where the iris prolapses, from those where the lens and iris are *in situ.* Apart from the local differences, they present certain features in common, such as a more or less pronounced infiltration of the uveal tract, an organization of the exudation on the surfaces of the iris and ciliary processes, and in the interior of the vitreous the optic nerve or its sheath is, as a rule, infiltrated with round cells. If the case is far advanced, we find some atrophic changes in portions of the uveal tract. The connective-tissue formation in the vitreous brings about by its contraction certain mechanical changes in the structures which afford attachment to the newly formed bands and membranes; hence the difference alluded to above. In a typical, well developed case of irido-cyclitis we have the following changes: a total adhesion between the posterior surface of the iris and anterior lens capsule, a pushing forward of the lens and attached iris by the exudation in the vitreous, and at the same time a retraction of the iris angle by the connective-tissue bands in the posterior chamber and ciliary region of the vitreous. These, by their contraction, cause a total detachment of the retina, and later a detachment of the posterior portion of the ciliary body and anterior portion of the choroid from the sclerotic. Such typical conditions are found in Cases 5 and 16. In Case 7 we find an earlier stage of the process, the newly organized tissue having as yet only produced a detachment of the anterior portion of the retina and an elongation and backward inclination of the cells of the pars ciliaris retinæ (the wound was in the sclerotic). Should the iris prolapse or the lens be injured or lost, the picture is somewhat complicated, the mechanical problem being different. Thus in Case 1 there is an organized band of connective tissue extending from a corneal scar, *through the lens*, into the vitreous, and there dividing into two bands, which pass to the ciliary processes above and below respectively. Here the traction has only been sufficient to bring about an elongation and forward inclination of the cells of the pars ciliaris. In Case 11 where we find prolapse of the iris and lens capsule, with an escape of the lens, the traction of the cyclitic membranes

has brought about a detachment of the posterior portion of the ciliary body and of the anterior portion of the choroid. In Case 16 there is prolapse of the iris, and the connective-tissue contraction has as yet only produced an elongation of the cells of the pars ciliaris. In four of the six eyes belonging to this group, marked changes of an inflammatory nature are found in the optic nerve. In the two others, no sections involving the optic nerve were available. In one of these, however (Case 5), the infiltration of the choroid and retina towards the posterior pole of the eye is so marked that an implication of the optic nerve can be inferred. In this case there occurred, eighteen days after the enucleation, six weeks after the injury, an acute iritis or irido-cyclitis in the other eye, which was cured in six weeks.

In the third stage—phthisis bulbi—we find more advanced changes. The cellular infiltration has gradually disappeared. If present at all, it is only in the most anterior portion of the uveal tract. The cyclitic membranes and bands are much denser, the interior of the eyeball being one mass of connective tissue. This is pervaded by blood-vessels of new formation, and in many cases in the neighborhood of the ciliary processes we find the so-called "tubular excrescences of the uveal pigment,"[1] on the nature of which there has of late years been so much controversy. The most acceptable view as to their origin is that expressed by Alt,[2] and more lately by Treacher Collins,[3] who applied his method of bleaching of the uveal pigment in his studies. Both authors consider them as proceeding from the pigment epithelium, and as having a glandular nature. I can in no way agree with Berger,[4] who considers them as blood-vessels. The traction on the neighboring structures is much more pronounced than in the second stage; the retina is totally detached from the choroid; the posterior four fifths of the ciliary body and anterior portion of the choroid are separated from the sclerotic. The traction bears, moreover, on the

[1] See Case 8, Fig. 3.

[2] *Lectures on the Human Eye.* By Adolf Alt. New York, 1884.

[3] "The Glands of the Ciliary Body in the Human Eye." E. Treacher Collins. *Transactions of the Ophth. Soc. of the United Kingdom*, xi., 55.

[4] *Beiträge zur Anatomie des Auges.* Emil Berger. Wiesbaden, 1887.

external coats of the eyeball, especially on the insertion of the tendon of the ciliary muscle at the sclero-corneal junction, causing an alteration in its shape—a shrinking. The whole uveal tract becomes atrophic, there being at the same time an interstitial growth of connective tissue. The optic nerve also is atrophic. The lens, if present, is cretaceous; the cornea vascularized; the sclera thickened. Examples of this stage are to be found in Cases 6, 8, 13, 17 and 24. In Case 8 sympathetic ophthalmia had broken out in the other eye.

At a still later period we have a deposit of lime salts and formation of bone in different structures. None of these eyes show these changes.

INFLUENCES OF FOREIGN BODIES.

The influence of foreign bodies, lodged in the interior of the eye, in determining an inflammation, depends greatly on their septic or aseptic condition. Infected foreign bodies differ as to the virulence of the infection. If this virulence is pronounced a panophthalmitis quickly results, if it is moderate an irido-cyclitis of a more or less purulent or plastic character develops, whilst in cases in which the infection is very slight a localized inflammation may be the result, terminating in an encapsulation of the foreign body without the process advancing any farther. Aseptic foreign bodies are generally those which have been brought to a high degree of heat prior to their entrance into the eye[1]; such as pieces of guncap, etc. These, although not liable to produce either purulent or sympathetic inflammation, may bring about a plastic or puriform inflammation in the neighboring tissues either through mechanical irritation or their chemical action.[2] If the foreign body be of any size,

[1] Knapp: "Fermentation, Putrefaction, and Suppuration." *N. Y. Medical Record*, December 25, 1886.
Leber: *Ueber die Wirkung vom Fremdkörpern im Innern des Auges.* International Congress, London, 1881.
Leber: "Beobachlungen über die Wirkung Auge eingedrungener Metallsplitter. *Gr. Arch.*, xxx., p. 243.

[2] Leber: *Die Entstehung der Entzündung und die Wirkung der entzündungerregenden Schädlichkeiten.* Leipzic, 1891.
Kostenitsch: "Pathologisch-anatomische Untersuchungen über die Zündhütchenverletzungen des menschlichen Auges." *Gr. Arch.*, xxxvii., 4.

the plastic inflammation may be so extensive, as in the end to bring about a phthisis bulbi as in 13. In eleven of the thirty eyes examined the trouble originated in a foreign body. In Case 10 the eyeball was enucleated after an ineffectual attempt to extract it; in Cases 27 and 28 for an incipient panophthalmitis; in 20 and 21 for a cyclitis in its primary stage; in Cases 5, 7, 16, and 26 there was a well marked irido-cyclitis (in Case 5, as already mentioned, sympathetic ophthalmia broke out eighteen days after the enucleation); in Cases 6 and 13 (Figs. 2 and 4) the foreign body was capsulated and the process had gone on to phthisis.

BACTERIOLOGICAL INVESTIGATIONS.

Nineteen eyes, from Case 12 to 30 (inclusive) were examined from this standpoint.

METHOD.—The method employed in all these investigations was as follows: the eyeball at the time of the enucleation was placed in a sterilized and closely stoppered jar. As soon as feasible, inoculations were made into gelatine and agar, from the intervaginal space of the optic nerve and from the interior of the eyeball. In making the former, the cut end of the optic nerve was first scorched with the blade of a red-hot knife; the point of a carefully sterilized platinum needle was then introduced into the intervaginal space, withdrawn, and the desired tube inoculated, repeating the process as often as desired. An opening was then made through the sclerotic with a red-hot knife, the lips kept opened with the blades of sterilized forceps, the platinum needle introduced, moved around a little, and the tubes inoculated in the ordinary way.

At first the inoculations were made in the shape of puncture cultures (both into glycerine agar and into gelatine), and if these yielded positive results pure cultures of the different microbes present were obtained by means of plate cultures or Esmarch tubes. This method was found a little too complicated, so that in the later investigations the Esmarch's were inoculated directly from the intervaginal space of the optic nerve and from the interior of the eyeball.

Cover-glass specimens were made in some, but not all the cases. The search for the microbes in the tissues was only made in a few of the cases, due to a lack of time; some of the specimens, moreover, were overgrown by budding and fission fungi, notwithstanding the fact that the eyes had been hardened in alcohol, thus rendering the examination invalid.

RESULTS.—As can readily be seen, the methods just described would, if anything, favor a negative result. As the platinum needle could only come into contact with a very limited portion of the intervaginal space it would perhaps have been better to have excised a piece of the nerve, to have carefully sterilized its external surface, then to have placed it into sterilized broth, and to have broken it up into small pieces in its interior, and then if a positive result was obtained to have isolated the different microbes by means of Esmarch tubes or plate cultures. With regard to the cultures from the interior of the eye, it would perhaps have been also better, as more likely to yield a positive result, to have, as practised by others, opened the eyeball with sterilized instruments under some neutral and sterilized liquid, and to have made the cultivations from the points where the exudation was most marked—from the neighborhood of foreign bodies, as it is a well-known fact, that in the latter case the bacteria are, as a rule, only found in their immediate surroundings, especially if the inflammation be not far advanced. These faults in the process will explain the almost uniform negative result of the optic-nerve sheath cultures, and of those from the interior of the eye where a foreign body was lodged in the vitreous—thus in a way detracting from their importance; they however only increase the value of the positive results obtained.

The detailed account of these investigations will be found in the reports of the cases. I will, however, now give a general *résumé* of the results obtained.

In Case 19, where the eyeball was enucleated before the outbreak of any inflammation, there was, as one would expect, a negative result. There were five cases of incipient

panophthalmitis[1]; in three the results were positive (Cases 15, 18, and 25). Among these are counted two where the tube cultures proved negative, but where numerous cocci, irregularly arranged in groups, were demonstrated in the cover-glass specimens prepared directly from the exudation in the vitreous. In the other case (Case 15) a bacillus was cultivated both from the intervaginal space and from the interior of the vitreous. This bacillus was thoroughly worked up, as can be seen in the report of the case, and its pathogeneity and ability to produce suppuration fully established. Its characters do not tally with any of those described in the text-books. It seems to belong to the proteus group.

Out of six eyes which were enucleated during the first stage of a cyclitis,[2] positive results were obtained only in three cases (12, 14, 23). All these were obtained from the interior of the vitreous, those from the intervaginal space being all negative. The microbe found was invariably the staphylococcus pyogenes aureus (Rosenbach).

In the three cases where there was a full developed iridocyclitis, the staphylococcus pyogenes aureus was isolated in two from the interior of the eyeball (Cases 22 and 30); in one (16) from the intervaginal space. In this case a non-pathogenic coccus was cultivated from the interior of the eye, but no staphylococcus pyogenes.

The results were negative in the four phthisical eyes examined (Cases 13, 17, 24, 27). In Case 13 a large piece of gun-cap was embedded in the vitreous (Fig. 4), and although over fifty sections were examined, no microbes of any kind could be discovered in the tissues. This bears out Leber's and Kostenitsch's investigations[3] on the subject of gun-cap injuries. No tests were made as to the presence of copper salts in the different tissues.

We therefore have 9 positive results from the interior of the eyeball and 2 from the intervaginal space, in a total of 19 cases.

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[1] Cases 15, 18, 25, 28, and 29.

[2] Cases 12, 14, 20, 21, 23, 26.

[3] *Ueber die Entstehung der Entzündung und die Wirkung der entzündungerregenden Schädlichkeiten.* Theo. Leber, Leipzig, 1891.

"Pathologisch-anatomische Untersuchungen über die Zundhütchenverletzungen des menschlichen Auges." Kostenitsch. *Gr. Arch.*, xxxvii., 4.

CONCLUSIONS.—The conclusions to be drawn from these investigations, taking into account the methods employed and the results obtained, especially in the fully developed cases of irido-cyclitis and panopthalmitis, are:

(1) The inflammation following injuries is due to an infection with pyogenic germs. In only exceptional cases can it be attributed to purely mechanical or chemical influences.

(2) The germ bringing about this inflammation is in by far the greater majority of the cases the ordinary staphylococcus pyogenes aureus, my experience in no way agreeing with that of Haab and Poplawska, who in cases of panophthalmitis find a peculiar bacillus.[1] In only one case (Case 15) was a bacillus found. This differed essentially from Haab's, as anybody can see who compares both descriptions. That inflammation of a suppurative character can be produced by microbes other than the staphylococci is universally acknowledged, but it is the exception, and not the rule. Dr. Knapp, about two years ago, enucleated an eye for an intensely severe and rapidly developing panophthalmitis, and in the cover-glass specimens prepared from the pus in the vitreous he found Fraenkel's pneumococcus.[2] Limbourg and Levy have also found the pneumococcus in cases of panophthalmitis.[3]

(3) On account of the method employed, no conclusions can be drawn from the almost uniformly negative results obtained in the inoculations from the intervaginal space.

CONSIDERATIONS WITH REGARD TO SYMPATHETIC OPHTHALMIA.

The danger of sympathetic ophthalmia in the healthy eye is always a source of great anxiety to the oculist in every case of traumatic irido-cyclitis; hence the assiduity with which the master minds in ophthalmology have devoted themselves to the solution of the dark problem of its production and the manner in which the inflammation

[1] Haab, *Fortschritte der Medecin*, ix., p. 781.
Poplawska, ARCH. OF OPHTH., xxi., 1.

[2] This case has not yet been reported, and I mention it with Dr. Knapp's kind permission.

[3] Limbourg and Levy, *Arch. f. experiment. Path. und Pharmak.*, xxviii., 153.

is transmitted to the second eye. The literature on the subject is most extensive. Mackenzie, who in the second edition of his work on *Diseases of the Eye*, in 1844, first gave a complete clinical picture of the disease (which to this day has not been improved upon), declared himself for a direct propagation of the inflammation along the optic nerves through the chiasm. Then came the era of reflex neuroses, and the ciliary nerve theory made its appearance, this being first advocated by Heinrich Müller in 1859. This theory held sway till modern times, some of its advocates believing in a direct transmission of the inflammation up the ciliary nerves to the brain, and down the ciliary nerves of the other side; some in a sympathetic reflex irritation in the peripheral terminations of the ciliary nerves of the healthy eye, which brings about first vasomotor disturbances in the uveal tract, and which gradually develops into an inflammation of a more or less plastic character. The advocates of the ciliary nerve theory to-day are believers in this last mode of transmission. Then came the discovery of bacteriology and of the microbic origin of suppuration. The minds of ophthalmologists were immediately directed towards a transmission through the lymphatics of the optic nerve. Colsman, in 1877, is the first, I believe, who, in a description of a case of sympathetic neuro-retinitis after the enucleation of the first eye, revived the theory of a transmission through the lymphatics of the optic nerve.[1] Knies,[2] Leber,[3] McGillavry,[4] Berlin,[5] Snellen,[6] Poncet,[7] came out in defence of this theory, especially after Knies' classical case of double-sided iritis serosa. To Deutschmann, however, belongs the glory of first attempting to produce an *experimental* proof of the theory.[8] Hitherto all had been surmise. The problem was now carried into the field of experimental science.

[1] *Berliner klin. Wochenschrift*, 1877, No. 12.
[2] Knapp's ARCHIVES, ix., 2, 125 (English edition).
Ophth. Beiträge als Festgabe Friedrich Horner's. Wiesbaden, 1881.
[3] *Arch. f. Ophth.*, xxvii., 1, 325.
International Med. Congress, London, 1881.
[4] International Congress, Amsterdam, 1879. *Ann. d'Oculistique*, *t.* 82, p. 172.
[5] *Volkmann's Sammlung klin. Vorträge*, No. 186, 1880.
[6] International Congress, London, 1881.
[7] International Congress, London, 1881.
[8] *Arch. f. Ophth.*, xxviii., 2, 291.

Anatomical investigations, conducted in eyes removed to avert the danger of sympathetic ophthalmia or, in cases where it had already broken out, to influence its course favorably, all tend to show that in every well marked case of cyclitis there is a tendency for the optic nerve to be implicated. See the statistics of Alt [1], Berger [2], and those here published. In fifteen of the twenty-five eyes which I examined histologically, there existed some cellular infiltration of the optic nerve or its sheaths, and if we consider only the cases of panophthalmitis or fully developed irido-cyclitis, there is scarcely an exception. The ciliary nerves are also involved in a good proportion of the cases; Berger found them affected in nine out of fourteen cases; I found changes in ten out of twenty-five. These changes have not, however, in my mind, the importance that the inflammation of the optic nerve or its sheaths has, being mostly limited to a moderate cellular infiltration of their sheaths, especially in their passage through inflamed areas; this is no more than one would expect.

The ciliary-nerve theory rests on purely hypothetical grounds—not being supported by any experimental fact—those of Rumpf and Mooren not having been confirmed by Ker, the results claimed being due, as pointed out by Knies, in Prof. Horner's *Festgabe*, to a non-differentiation between the symptoms of sympathetic irritation and those of sympathetic inflammation. Moreover, this theory cannot hold its own even on theoretical and clinical grounds. Nowhere else in the body can we find any similar affection; there is no other example of a reflex neurosis being converted into an inflammation; wherefore then should this new function be invented in a certain set of nerves to explain this affection? It would seem more rational to fall back on a peculiarity which another set of nerves connected with the eyes present, and which is not found elsewhere in the body—*i. e.*, the crossing and mingling of the fibres of the optic nerves at the chiasm—allowing us to explain the transmission of the inflammation by direct continuity of tissue through the

[1] *Arch. of Ophth. and Otology*, v., 3 and 4.
[2] *Beiträge zur Anatomie des Auges.* Emil Berger. Wiesbaden, 1887.

lymphatics of the optic nerve proper or through those of its sheath. It must be admitted, however, with regard to this view, that no very satisfactory explanation has been given for the non-occurrence of a basilar meningitis. There are certain clinical facts which are utterly unexplainable under the ciliary-nerve theory: (*a*) why is not every case of sympathetic ophthalmia preceded by a period of irritation? (*b*) cases where large aseptic foreign bodies, like pieces of gun-cap, are imbedded in the interior of the eye for years without causing any sympathetic trouble (see Case 13, and Leber's and Kostenitsch's investigations)—one could scarcely imagine anything more likely to irritate the ciliary nerves; (*c*) cases of sympathetic ophthalmia occurring after enucleation.[1] We must therefore conclude that *the ciliary-nerve theory is utterly devoid of proof and altogether insufficient to explain the transmission of the inflammation from one eye to the other.*

With regard to the carrying over of the microbes, or their products from one eye to the other, three routes have been advocated: (1) Berlin[2] in 1880 held that the microbes or their ptomaïnes were taken up into the general circulation and distributed all over the body, finding however a suitable soil in the uveal tract of the healthy eye; (2) Deutschmann[3] supports in his different communications the intervaginal space of the optic nerves as the path pursued by the micro-organisms in their passage from the injured to the healthy eye: (3) Gifford[4] advocates an exit of the microbes along

[1] Mooren, *Ophthalmiatr. Beobachtungen*, 1867.
Colsman, *Berliner klin. Wochenschrift*, No. 12, 1877.
Steinheim, *Arch. f. Augenheilkunde*, English Edition, ix.
Nettleship, *Brit. Med. Journal*, April 17, 1880.
White, *Brit. Med. Journal*, April 16, 1881.
Frost, *Transactions of the Ophth. Soc. of the United Kingdom*, ii., p. 21.
Critchett, *Royal London Ophth. Hosp. Reports*, x., 322.
Bower, *Brit. Med. Journal*, May 26, 1883.
Gunn, *Royal London Ophth. Hosp. Reports*, xi.
Schmidt, *Arch. f. Augenheilkunde*, 1877, p. 177.

[2] *Volkmann's Sammlung Vorträge*, No. 186.

[3] *Arch. f. Ophth.*, xxviii., 2, 291.
Arch. f. Ophth., xxix., 4, 261.
Arch. f. Ophth., xxx., 3, 77.
Arch. f. Ophth., xxx., 3, 331.
Ophthalmia Migratoria. Hamburg, 1889.
Arch. f. Augenheilkunde, xxii., 119.

[4] ARCH. OF OPHTH., xv., 2, 153.
International Med. Congress, Washington, 1887.

the perivascular lymphatics of the central blood-vessels, thence with these into the orbit, through the sphenoidal fissure to the base of the brain, and down the intervaginal space of the healthy nerve.

Deutschmann's explanation is undoubtedly the most probable. Gifford's objections are based on the directions of the lymph currents. Apart from the difficulty in determining these accurately (Gifford himself has lately modified his old views somewhat)[1], there is good reason to believe that the lymph currents are not the same in cyclitic as in healthy eyes.

It must, however, be admitted that whilst Deutschmann's theory is the most rational and explains in the most satisfactory manner the conditions under which sympathetic ophthalmia makes its appearance, it still lacks full experimental confirmation, for in the greater number at least of his cases of experimental sympathetic ophthalmia the inoculated rabbits died either from a purulent meningitis or from a general systemic infection, thus in a way marring the result. This, I believe, is due to the production of a too violent inflammation in the first eye; it would be more desirable to induce a slow-going form of irido-cyclitis such as is mostly seen producing sympathetic ophthalmia in man; this can be obtained by diluting the culture four to five times before making the inoculation. This method would of course entail a large number of negative results, as it is by no means in all but only in a small percentage of cases of chronic irido-cyclitis that sympathetic ophthalmia occurs. In a rabbit which I inoculated in this manner with the staphylococcus pyogenes aureus I brought about such a chronic inflammation, but no sympathetic ophthalmia developed in the other eye although the rabbit was kept several months.

Another point which is not quite definitely decided is whether the inflammation in the second eye is due to a direct action of the pyogenic germs, or whether only their ptomaïnes have been carried over from the first affected eye. Every-

[1] ARCH. OF OPHTH., xxi., 2, 181.

thing points to a carrying over of the micro-organisms themselves; and the few experiments made by Deutschmann tend to confirm this view; they are, however, not numerous enough to warrant a definite conclusion.

REPORT OF CASES.

CASE I (Fig. 1).—A. B. "Cyclitis after injury." Enucleation on April 4, 1883, by Dr. H. Knapp.

Anatomical Examination; The cornea presents a large scar running across its inferior half. The condition of the scar is most interesting. Its surface projects beyond the level of the cornea and is covered with epithelium. Superficially it is mostly made up of spindle cells, more or less regularly arranged, with their long axes parallel to each other and to the surface

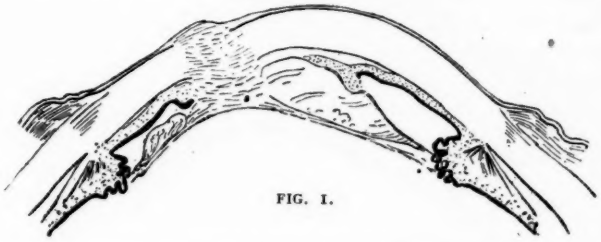

FIG. I.

of the scar—thus simulating in a manner the lamellar structure of the cornea. Deeper the spindle cells are no longer so regularly parallel; several blood-vessels, proceeding apparently from the periphery of the cornea, are found among them. Still deeper the cells assume an antero-posterior direction. This new-formed connective tissue is directly continuous with a fibrous band which passes back, through the pupil and *through the periphery of the lens*, dividing it into two segments. At the level of the posterior surface of the lens, it splits into a superior and inferior band, which proceed to the ciliary processes above and below respectively. The structure of this band is densely cellular; its bulk is constituted by spindle cells having a more or less antero-posterior direction, their arrangement being much closer than that of those entering into the formation of the corneal scar; numerous lymphoid cells are also to be found among them, as well as a few scarce blood-vessels. The surfaces

of the band are very irregular; the lower is loosely connected with the lower half of the iris, but much more intimately with the lower segment of the lens, portions of the lens capsule being involved in its fibrous tissue; the superior is loosely connected with the upper segment of the lens. Of the two bands into which the one just described divides, the lower is the much more distinct; they are likewise made up in their greater part of spindle cells, which follow the directions of the bands. We find the angle at the point of subdivision filled with spindle cells, not so thickly nor so regularly arranged as in the bands proper; their direction is more or less vertical.

The cornea shows the usual round-cell infiltration in the neighborhood of the scar and at the periphery. The circumcorneal blood-vessels are dilated and surrounded by round cells. The sclera is normal. Near the ciliary region we find some slight infiltration of the sheath of one or two of the ciliary nerves as they pass through it. The iris is not involved in the wound. The lower half is loosely connected with the lower surface of the fibrous band passing back from the corneal scar. The upper one forms a broad synechia with the upper segment of the lens. The iris is applied to the posterior surface of the cornea though not adherent to it; it is atrophic, there being at the same time a relative increase in its connective-tissue elements; in its greater portion it is only very moderately infiltrated; where, however, it forms the synechia with the lens, it is spread out fan-shaped and is markedly infiltrated. The ciliary body is atrophic. The cells of the pars ciliaris retinæ are little if at all altered in the upper half, there being, however, some cellular deposit on their surface and some organization of the neighboring vitreous; in the lower half they are elongated and inclined forwards, on account of the greater traction on them. The choroid shows a relative increase in its connective-tissue elements and some dilatation of its blood-vessels. These changes are most marked near the optic-nerve entrance. The retina is normal. The lens is divided completely into two segments by the fibrous band proceeding backward from the corneal scar. Its central portion is distinctly marked off from the remainder: it is most disorganized; its fibres are more swollen; there are more vacuoles, filled at places with round cells, at others with myeline globules. In the neighborhood of the synechia with the iris large numbers of lymphoid cells are to be found among the lens fibres. This

synechia takes place by a growth of connective tissue springing from the iris, which interlaces with the broken and swollen fibres. The lens capsule is normal, that of the upper segment being lost in the synechia between the iris and lens, that of the lower in the corneo-vitreal synechia. In the zonula and anterior portion of the vitreous there is some connective-tissue organization.

CASE 2.—H. H., æt. fourteen years. "Perforating wound of globe," L E.

History: Patient was brought to the Dispensary on *November* 6, 1884, the left eye having been struck by a stone the day before.

Condition: There was a wound extending entirely across the cornea into the ciliary region—no perception of light—enucleation advised. Eyeball enucleated on November 8, 1884, by Dr. T. R. Pooley.

Anatomical Examination: A wound extending across the cornea obliquely from above downwards. Through it iris and lens capsule prolapse and most of the lens has escaped. The iris in the wound is very much swollen and infiltrated with lymphoid cells, as well as extravasated blood. In the wound, or rather just outside it, there is some swollen lens matter. The gap contains blood and numerous round cells seemingly thrown out from the edges of the wound. Posteriorly there is a large extravasation of blood on the external surface of the sclerotic, near the optic-nerve entrance; the loose tissue in the situation is also markedly infiltrated with round cells. The ciliary nerves as they pass through the infiltrated areas of the sclerotic show, at places, some cellular infiltration of their sheaths. The non-prolapsed half of the iris is applied to the posterior surface of the cornea; it is intensely pigmented and it is difficult to make out its histological details; it is thickened and there is some lymphoid-cell infiltration. The posterior extremity of the ciliary body and the choroid are totally detached from the sclerotic by a large extravasation of blood into the supra-choroideal space. The ciliary body is not much altered; posteriorly and externally, where the choroid commences to be detached, there is some cellular infiltration; it is deeply pigmented. The choroid has 5-6 times its normal thickness, due to an extravasation of blood into its substance; it is also moderately infiltrated. The retina is mostly healthy; at places there is some slight cellular infiltration, at others some hemorrhage into its substance; a moderate cellular deposit is scattered over its surface. There is some infiltration of the lymph channels of the optic-nerve.

The anterior portion of the vitreous and both chambers are filled with blood and *round* cells.

CASE 3.—M. M., æt. twenty-five. "Perforating wound of ciliary region," L E.

History: On *June 22*, 1883, patient presented himself at Dr. D'Oench's private office. He had been struck in the left eye with a stick, and showed a vertical cut in the ciliary region about ½ inch long, also two smaller wounds at the inner canthus and on the bridge of the nose. The iris had prolapsed through the ocular wound. Prolapsed iris abscised, wound cleansed, atropine. *June 23d*, pain, chemosis of ocular conjunctiva; towards evening, muco-purulent discharge. *June 24th*, chemosis increased; patient referred to New York Ophthalmic and Aural Institute, where eyeball was enucleated.

Anatomical Examination: This revealed the injuries attendant on a profound injury to all parts of the eye. The lens had escaped through the wound, the corneal lip of which overlaps the scleral considerably. There has been a large intra-ocular hemorrhage, which has brought about a detachment of the choroid from the sclerotic, and of the retina from the choroid. The whole uveal tract is infiltrated with blood, rendering its structure scarcely recognizable. Large masses of blood are found in the anterior and posterior chambers, as well as in the little vitreous left. Schlemm's canal and Fontana's spaces are on the side opposite the wound, distended with blood. The optic nerve shows a slight degree of inflammatory infiltration. There is some lens capsule in the wound.

CASE 4.—C. D., æt. fourteen years. "Perforating wound of globe—panophthalmitis."

History: December 27, 1883, patient came to Dr. H. Knapp's office. He had been struck in the eye two days before, whilst working in a factory. Condition: A horizontal wound along inner half of cornea, through which pus escaped; whole anterior chamber filled with pus, only outer margin of iris visible; visual field narrowed. Sent to Institute. *December 28th.*—Considerable pain during the night. *December 30th.*—Free from pain during the night; pus in anterior chamber diminished, but still escaped through wound. *January 1st.*—Condition about the same; has had pain at times; T increased. *January 3d.*—Pain at night; perception of light almost entirely gone. *January 5th.*—Enucleation by Dr. H. Knapp.

Anatomical Examination: There is a perforating wound of the cornea and lens with the lesions of a subsequent panophthalmitis; in the centre of the cornea a scar deeply infiltrated with round cells, to which a portion of the iris is loosely adherent. The neighboring cornea as well as the region of Schlemm's canal is deeply infiltrated. The circumcorneal blood-vessels are very much dilated and surrounded by an abundant cellular exudation, which also pervades to a greater or a less degree the loose episcleral tissue. The sclerotic is moderately infiltrated, especially near the optic-nerve entrance and anteriorly near the sclero-corneal junction. The ciliary vessels passing through it are distended and surrounded by round cells. The ciliary nerves, also, at places, show some cellular infiltration of their sheath. The iris is immensely swollen and pervaded by an enormous number of lymphoid cells; a portion is loosely connected with the corneal scar. The anterior and posterior surfaces, especially the latter, are covered by a thick layer of round cells; this exudation occupies the whole posterior chamber, pushes the iris forward, more or less obliterating the iris angle This is still further enhanced by the intense swelling of the parts which enter into its formation.

The ciliary body is markedly infiltrated with leucocytes. The inflammation shows itself in this region in a very abundant deposit on the surface of the ciliary processes, which is continuous with that on the posterior surface of the iris, filling the zonula completely. There is some tendency towards organization of this exudation—some cells having acquired a distinct spindle shape. The blood-vessels of the choroid are distended with blood; there is abundant cellular infiltration, especially in their neighborhood; at places there is some extravasation of blood. The retina is, at one or two places, partially detached from the choroid, this being produced by an extravasation of blood between them It is very much infiltrated, its structure being at places scarcely recognizable. There is a large accumulation of round cells on its internal surface, especially near the optic-nerve entrance, where they are accumulated in enormous numbers.

The optic nerve is also very much infiltrated with lymphoid cells, these being mostly found between the bundles of nerve fibres and in the intervaginal space. They are accumulated in large numbers on the surface of the papilla.

A wound is in the centre of the lens. The structure of the lens is greatly altered; its fibres are separated and swollen, and between

them we find large numbers of pus cells, which pass through the opening in the capsule and mingle with the round and spindle cells in the posterior chamber and pupillary area. The anterior chamber is occupied by a cellular exudation, which is mostly deposited on the anterior surface of the iris; a portion of it is partially organized and connects a portion of the iris to the scar. The pupillary area and posterior chamber are filled by the same exudation. The vitreous is also very much infiltrated. On the posterior surface of the lens there is an abundant cellular deposit which is partially organized.

CASE 5.—C. B. "Cyclitis after injury; foreign body (right eye); sympathetic ophthalmia (?) in the other eye coming on after the enucleation."

History: Injury received on *July* 4, 1884, enucleation *August 1st* by Dr. H. Knapp. Healing smooth, patient discharged from Institute on *August 7th*. *August 18th* patient came to Dispensary. L E: Iris dull, slight circumcorneal injection, fundus veiled, venous congestion of the retina, no neuro-retinitis V = $\frac{4}{8}\frac{0}{0}$.

Diagnosis: Irido-choroiditis sympathica (?). Readmitted *August 20th*. Some opacity of fundus and slight pericorneal injection. *August 25th*, injection disappeared, pupil *ad max.* dilated, sees well. Improved steadily. Discharged *September 7th*, cured.

Anatomical Examination: There is a wound in the periphery of the cornea, penetrating through the iris and zonula into the vitreous. A piece of steel $2''' \times 4'''$ (rectangular in shape), was found imbedded in a mass of exudation in the ciliary region of the vitreous.

The cornea is moderately infiltrated. The circumcorneal blood-vessels are widely dilated and surrounded by numerous round cells. Some cellular infiltration of the sclerotic. The ciliary nerves, in their passage through it, show a moderate infiltration of their sheath. The iris presents the usual condition met with in cyclitic eyes—*i. e.* a total adhesion between its posterior surface and the anterior lens capsule, with the consequent obliteration of the posterior chamber; a retraction of its angle, caused by the traction of the cyclitic membranes; and a marked, but not excessive, round-cell infiltration. The posterior extremity of the ciliary body is detached from the sclerotic by the cyclitic membranes, the ciliary processes being drawn forward and inward. There is an abundant infiltration of its substance. The choroid participates in the general cellular infiltration of the uveal tract, which is here more marked than elsewhere; at places the round cells form large foci. The retina is totally detached, and shows

the usual degenerative changes. No sections involving the optic nerve were available, the eyeball not having been preserved as perfectly as one would desire; but from the marked infiltration of the posterior portion of the choroid, it is more than probable that it participates in the general inflammation. The lens with the adherent iris is displaced forwards by the exudation in the ciliary region. The whole ciliary region of the vitreous is occupied by newly formed membranes, which, by the traction they exert on the structures to which they are attached, have brought about a detachment of the retina, of the posterior portion of the ciliary body, and a retraction of the iris angle. Besides the connective tissue cells making up these membranes, they are found abundantly infiltrated with round cells. The number of blood-vessels of new formation is remarkable. Near the surface of the ciliary processes they show some slight diffuse pigmentation.

Case 6 (Fig. 2. See plate at end of paper). J. H., æt. twelve years. "Irido-cyclitis traumatica—phthisis." Enucleation on *June* 2, 1883, by Dr. H. Knapp.

Anatomical Examination: There is a penetrating wound of the cornea, near the sclero-corneal margin, which involves the lens and the vitreous. The corneal wound is filled with spindle cells having an antero-posterior direction. Mingled with them are numerous round cells, scattered and in clusters. This tissue is somewhat vascularized. From the posterior surface of the cornea, the connective-tissue continues *through the lens* into the vitreous; a portion of the iris is loosely attached to it; the round and spindle cells constituting it are very numerous and closely arranged; as the band passes between the two segments of the lens, we find some lens capsule and broken ends of lens fibres involved in it. The whole anterior portion of the vitreous is converted into a mass of fibrous tissue in the shape of bands, which pass in different directions, and which have produced a detachment of the retina, the posterior portion of the ciliary body, and the anterior portion of the choroid. Lymphoid cells are scattered throughout this mass of tissue, which, as usual, is in its greater part made up of spindle cells. It is permeated by numerous blood-vessels. Just behind the lens there is a vesicle, distinctly encapsulated, at least posteriorly; its contents consist of numerous round cells, blood, and broken-down matter; it may contain a foreign body, although none was found.[1] There is a marked cellular infiltra-

[1] Only one half of the eyeball was cut, the other being mounted in gelatine after the method of Priestley Smith, by Dr. W. A. Holden (Fig. 2).

tion, as well as some vascularization of the cornea. The sclerotic is likewise infiltrated at the point where the detachment of the choroid commences. One half of the iris is folded and attached to the fibrous band. The whole uveal tract is densely infiltrated. The retina is totally detached and is lost in the mass of connective tissue filling the vitreous The lens is broken up.

CASE 7.—J. S., æt. sixteen years. "Irido-cyclitis traumatica—foreign body (?)," right eye.

History: February 15, 1882, patient brought to Dr. R. O. Born's office; foreign body in right eye. Eye seemed to improve for several days;—T, but not tender to the touch; pupil wide. Rest; atropine; bandage. *February 19th.*—Considerable pain during the night; eye very much injected, but no tenderness on pressure; V= o. *February 20th.*—Injection less; no pain. Towards night severe pain; six leeches to temple, after which pain subsided and patient fell asleep. *February 22d.*—No pain for two days; injection somewhat less; T. slightly decreased; no pain on pressure; some perception of light has returned. *March 9th.*—Enucleation by Dr. R. O. Born.

Anatomical Examination: There is a wound through the posterior portion of the ciliary body, behind the ciliary muscle. It is filled with very irregularly arranged new-formed connective tissue, in which spindle cells greatly predominate, their long axes being mostly at right angles to the lamellæ of the sclerotic. The connective tissue passes through the breaks in the sclerotic and ciliary body into the vitreous, where it expands into a large mass of newly organized tissue. We find evidence of the traction exerted by this new tissue posteriorly in a detachment of the anterior portion of the retina, anteriorly in a backward inclination of the cells of the pars ciliaris and of the processes supporting them. Internal to this new connective tissue, there is a large extravasation of blood. The cornea is moderately infiltrated, especially around the region of Schlemm's canal; the latter is filled with blood. The sclerotic is infiltrated with round cells clear back to the optic nerve entrance. Here and there we find some infiltration of the sheaths of the ciliary nerves as they pass through it. The iris only shows a more or less pronounced cellular infiltration, most marked at its angle. The posterior portion of the ciliary body, which was involved in the wound, is lost in the fibrous tissue filling it, there being besides some connective-tissue proliferation in the substance of the ciliary body itself. On the

opposite side it is abundantly infiltrated with round cells. The choroid is likewise profoundly infiltrated, especially near the wound and near the optic-nerve entrance. The anterior detached portion of the retina and the nerve-fibre layer near the optic-nerve entrance are permeated with lymphoid cells.

The optic nerve proper is also pronouncedly implicated. Round cells are found in the intervaginal space—when there is some proliferation of the endothelium. The lens is normal.

CASE 8 (Fig. 3, on plate, end of paper).—E. B., æt. thirteen. "Phthisis bulbi," sympathetic ophthalmia (R).

History: L E injured many years before and treated at this Institute—warning being given at the time of discharge of the possible danger of sympathetic ophthalmia. Not seen again until October, 1883. Enucleation on *October* 27, 1883, by Dr. H. Knapp.

Anatomical Examination: The eyeball is typically phthisical, almost every structure being invaded by a new growth of connective tissue. The cornea is completely vascularized. A broad band of connective tissue springs from its internal surface at the sclero-corneal margin, passes along the anterior surface of iris, across the pupil to a corresponding point on the other side; it is made up of spindle cells and contains numerous blood-vessels. The iris is completely atrophic, only a remainder of the uveal layer being recognizable; the remainder is lost in the mass of connective tissue filling up the anterior chamber. The ciliary body shows a large interstitial growth of connective tissue with atrophy of the ciliary muscle. The pigment layer is greatly hypertrophied and the shape of the processes much altered by the traction of the cyclitic bands which fill up the whole anterior portion of the vitreous. These are very dense and contain numerous blood-vessels, as well as the pigmented or partially pigmented tubules, which, springing from the uveal layer, go by the name of "tubular excrescences of the ciliary body" (Fig. 3). The choroid is also atrophic.

In the optic nerve we find proliferation of the interstitial connective tissue with atrophy of the nervous element. The lens is cataractous.

CASE 9.—R. R., æt. forty-five years. "Ruptured wound of the ciliary region" (R).

History: The patient came to the Dispensary on *November* 3, 1883. He had been struck by a chair whilst trying to separate

two combatants. There was a curved wound about 1″ long, along the zygomatic process, which was stitched up. The globe was ruptured in the ciliary region, the whole iris apparently lying in the wound—the whole anterior portion of the globe was filled with blood—eye bandaged and patient put to bed. The blood absorbed slowly and the prolapse was incised on *November 10th.* Enucleation on *November 17th* by Dr. H. Knapp.

Anatomical Examination: There is a wound in the ciliary region through which the lens has escaped in its entirety. The gap is filled by the ciliary body which prolapses through it and by some extravasated blood. The iris is gone. The ciliary body is markedly infiltrated with round cells; opposite the wound, it is detached from the sclerotic posteriorly by the hemorrhage between them. The choroid is also almost totally detached by the large extravasations of blood into the supra-choroideal space; being at the same time infiltrated with round cells and blood. The retina is totally detached and folded up—it is drawn towards the wound. There is a moderate infiltration of the optic nerve and a large extravasation of blood into its sheath. Near the wound the ciliary nerves are infiltrated with round cells. The vitreous is filled with blood—a large portion having been evidently lost.

CASE 10.—G. F., æt. fifteen years. "Corpus alienum in oculo" (L).

History: May 19, 1883. The injury being recent, an opening was made into the sclerotic 4–5 *mm* behind the wound, where the vitreous seemed most opaque; an electro-magnet introduced, but failed to bring out chip of iron; eyeball then enucleated by Dr. H. Knapp.

Anatomical Examination: There are only slight changes and limited to the uveal tract. The iris is moderately infiltrated, at one point being united to the anterior lens capsule. There is a cellular deposit on the ciliary processes around the place where the foreign body was lodged—the ciliary body itself is unaltered. The anterior portion of the choroid is infiltrated with lymphoid cells. The optic and ciliary nerves are normal.

CASE 11.—M. R. "Irido-cyclitis traumatica" (L).

History: July 21, 1883. Eye struck with a beer bottle. *September 5th*, enucleation by Dr. H. Knapp.

Anatomical Examination: There are two wounds—one in the cornea and another more internally in the sclerotic, behind the

ciliary body. The iris and lens capsule prolapse through the corneal wound, the greater part of the lens having escaped. The gap in the cornea is filled, besides, with a densely cellular mass, in which round cells greatly predominate. This cellular tissue is directly continuous with some tensely infiltrated newly organized tissue, which fills the whole ciliary region, and which is likewise continuous with that filling the gap in the sclerotic. This mass of new tissue also fills the anterior and posterior chambers, lining both surfaces of the half of the iris not involved in the wound. It contains in its interior the little that is left of the lens. It is partly vascularized.

The cornea in the neighborhood of the wound is very densely infiltrated and filled with blood-vessels of new formation, which are surrounded by numberless round cells. The scleral wound is filled with connective tissue, having a direction perpendicular to the lamellæ of the sclerotic. The cut ends of the retina and choroid posteriorly and of the ciliary body anteriorly are lost in this tissue. The ciliary nerves near this scar are infiltrated with lymphoid cells. Apart from the cellular deposit on both its surfaces, the iris shows a most pronounced infiltration with round cells. Opposite the scleral wound the posterior extremity of the ciliary body is detached from the sclerotic by the contraction of the mass of connective tissue in the ciliary region—the cells of the pars ciliaris show the usual elongation and forward inclination. There is a pronounced infiltration of the ciliary body (on both sides); as well as of the suprachoroideal space, with round cells. An abundant deposit is on the surface of the ciliary processes. The anterior portion of the choroid, opposite the scleral wound, is, like the adjacent ciliary body, detached from the sclerotic. This portion of the choroid shows some cellular infiltration ; elsewhere its structure is not much altered. The whole anterior portion of the retina is detached and degenerated ; posteriorly it is in situ and only shows a moderate cellular deposit on its surface.

The optic nerve is moderately infiltrated.

Case 12.—W. K., æt. twelve years. "Perforating wound in the ciliary region" (L).

History: Oct. 3, 1890, patient brought to the Dispensary ; he had been hit in the eye with a stone five days before. Condition: L E, wound in the ciliary region ; iris congested, a portion incarcerated in the wound ; pupil distorted, details of fundus not

recognizable, V = $\frac{1}{200}$. No pain. *Oct. 6th*, fundus dimly visible, disk veiled but less than before, V = $\frac{10}{200}$, inflammation diminished. *Oct. 31st*, V = $\frac{3}{200}$. Tn, fundus hazy, blood-vessels seen, disk not found (eye too unsteady). *Nov. 7th*, T1, indrawn scar in ciliary region (below and outwards), V = $\frac{3}{200}$. Other eye healthy in sight, iris and fundus. Enucleation, *Nov. 8th*, by Dr. H. Knapp.

Bacteriological Examination: According to the methods described above, three gelatine and one agar tubes were inoculated from the intervaginal space of the optic nerve; and five gelatine and one agar tubes from the interior of the vitreous. The four cultures from the intervaginal space proved negative. Of those from the interior of the eye, the agar and one gelatine tube proved negative, four gelatine tubes positive. Of the latter, in two only, the staphylococcus pyogenes aureus was isolated, in two, the staphylococcus pyogenes aureus and a non-pathogenic bacillus.

Anatomical Examination: There is a wound in the ciliary region in which the iris is incarcerated. The scar is, as usual, made up of more or less irregularly arranged connective tissue, which is very much infiltrated. The iris tissue in the wound is one mass of round cells. The cornea in the neighborhood of the wound and at the sclero-corneal junction shows the usual cellular infiltration. The anterior portion of the uveal tract—iris, ciliary body, and choroid—are markedly infiltrated; the infiltration is not marked in the iris and ciliary body. There is a slight cellular deposit on the surface of the ciliary processes. The optic nerve is moderately infiltrated with round cells, which occupy the lymph channels between the nerve fibres, as well as the intervaginal space. There is some proliferation of the pial endothelium.

Case 13. (Fig 4. end of paper.)—L. W., æt. nineteen years. "Phthisis bulbi" (R).

History: Patient came to Dispensary on *Nov.* 18, 1890. He had received a wound in the upper portion of the ciliary region, on *July 20th* of the same year, in an explosion of a gun-cartridge. There was no pain in the healing. The eye had been painful for three or four days. Condition: Indrawn scar in the ciliary region, eyeball shrinking,—T3, eye sensitive on pressure, V = 0. Other eye (L), V = $\frac{20}{15}$. *Nov. 22d*, edges of scar infiltrated, eyeball red and irritable. Enucleation by Dr. H. Knapp.

Bacteriological Examination : A plate culture and an Esmarch tube were inoculated from the intervaginal space ; and a plate culture from the interior of the eyeball. All proved negative. Over thirty sections, stained after Gram, Loeffler, and Weigert, were carefully examined and no trace of any micro-organisms were found. No tests were made as to the presence of copper in the different tissues.

Anatomical Examination : The eyeball is phthisical ; there is a scar at the sclero-corneal margin. Embedded in the centre of the eyeball is a gun-cap which lies under a portion of raised choroid ; where it protrudes into the vitreous it is surrounded by a mass of exudation (See Fig. 4 from a Priestley Smith gelatine preparation, prepared by Dr. W. A. Holden).

The scar occupies a good portion of the cornea ; and is made up of a mass of very closely arranged round cells, and some spindle shaped. Near the posterior surface of the cornea, we find the torn ends of Descemet's membrane involved in this tissue. The cornea is markedly infiltrated in its whole extent.

A large portion of the iris has been carried in with the gun-cap and its structural changes could only be studied in a few sections ; in these it showed a pronounced cellular infiltration, the round cells being at places accumulated into clusters. There is an organized deposit on its anterior surface.

The ciliary body only remains attached to the sclerotic by its anterior extremity, its posterior $\frac{3}{4}$ with the greater portion of the choroid being detached from the sclerotic, being drawn inwards by the contraction of the connective tissue in the vitreous. The supra-choroideal space is occupied by a reticular tissue, containing in its meshes numerous round cells, diffuse pigment, and extravasated blood. The ciliary body itself is densely infiltrated. The choroid in its whole extent is infiltrated with round cells. Both its surfaces are at different places covered with a hemorrhagic exudation. The retina is totally detached, being mostly converted into a mass of more or less infiltrated connective tissue.

The optic nerve is atrophic and shows a very slight degree of round-cell infiltration, which soon disappears as we proceed centripetally.

The whole ciliary region is occupied by newly organized connective tissue, which is most densely infiltrated, the round cells being accumulated here and there into foci. Numerous red blood corpuscles also are to be found. In the midst of this

mass of tissue we find the greatly disorganized remnants of the lens.

CASE 14.—E. B., æt. thirty-one years. "Cyclitis after injury" (R).

History: *Nov.* 22, 1890, patient came to Dispensary; the eye had been injured two weeks before, the patient running his eye into a wire fence. L E myopiai with -3.5 D $= \frac{20}{70}$; od. pale; F normal; color perception good; no congestion; no irritation. R E always weak. Enucleation by Dr. H. Knapp.

Bacteriological Examination: Immediately after the enucleation one Esmarch tube was planted from the intervaginal space, and two from the interior of the eyeball. The former proved negative, the two latter positive, both yielding pure cultures of the staphylococcus pyogenes aureus.

Anatomical Examination: There is a wound at the sclerocorneal margin, through which the iris prolapses in its entirety, and through which the lens has totally escaped. The anterior chamber and anterior portion of the vitreous is filled with blood, mixed with an abundant fibrinous exudate. The remaining changes are limited to the anterior portion of the globe; the iris, ciliary body, and anterior portions of the choroid and retina being markedly infiltrated. There is a fibrinous deposit on the surface of the ciliary processes and anterior portion of the choroid.

CASE 15.—J. D. "Panophthalmitis incipiens."

History: Patient received a perforating wound in the ciliary region in the early part of November, 1890. Healing without pain. Patient states that he could see with the injured eye till November 21st, when the eye became irritable, tender, and painful. V = o. Prolapse of iris. Enucleation on November 26th by Dr. H. Knapp.

Bacteriological Examination: Cover-glass preparations, prepared directly from the intervaginal space and the interior of the vitreous, showed nothing.

Puncture cultures, made both from the intervaginal space and from the interior of the eyeball, yielded positive results, and a peculiar bacillus was isolated. Its characters do not correspond with those of any of the microbes found described in the text, nor with those of Haab's panophthalmitis bacillus; hence I will describe them somewhat in detail. The bacillus was about 7 μ long, being rather slender. In cover-glass preparations, made from the growths in gelatine, they were arranged in zoogleic

masses. The bacillus was cultivated in gelatine, agar, and potatoes. In *gelatine* it developed with the utmost readiness, liquefying it with extreme rapidity almost as soon as it made its appearance; when planted in second and third generations the gelatine would be totally liquid in twenty-four hours. In a partially anaërobic culture (made by pouring a layer of sterilized oil on the surface of the gelatine after making the puncture), the liquefaction took place much slower, not commencing for months, the growth being somewhat peculiar; from the central stem four peculiar processes were given out, which were arranged crosswise; gradually, however, the growth was totally liquefied. In *agar* the bacillus thrived both in its interior and on its surface; in the latter situation it had a peculiar white, waxy appearance. On *potatoes* the growth at first was yellowish, but ultimately acquired a chocolate-brown color, resembling somewhat that of the glanders bacillus.

In order to prove the pathogenicity of this bacillus, an inoculation was made from a pure culture into the healthy vitreous of a rabbit, the usual precautions being observed; the eye went to ruin as the result of the purulent panophthalmitis set up.

From twenty-five to thirty sections were examined, after staining according to Gram, Loeffler, and Weigert, and in only two (stained after the latter's method) could two or three very faintly stained bacilli be demonstrated in the vitreous.

Anatomical Examination: There is a wound in the ciliary region through which both iris and ciliary body largely prolapse. The wound gap, where not occupied by those portions of the uveal tract and the surface of the prolapse itself, are one mass of pus cells, directly continuous with those filling up the anterior and posterior chambers and the vitreous. All the structures of the eye are intensely infiltrated with pus cells. Of special note is the infiltration of the sclerotic, of the sheaths of the ciliary nerves passing through it, of the loose tissue on the external surface of the sclerotic, around the optic-nerve entrance, and of the optic nerve itself (its sheath being more or less free).

Case 16.—E. S., æt. seven years. "Irido-cyclitis traumatica," foreign body (?), (R).

History: December 5, 1890, patient brought to Dr. Knapp's office. About three weeks before a spark had flown into his right eye whilst playing on the street; since then the eye had been inflamed and red; it was noticed five days before admission that he could not see out of the eye. Condition: Irido-cyclitis with a scar

at the sclero-corneal margin. Enucleation the same day at the Institute by Dr. H. Knapp.

Bacteriological Examination : Cover-glass preparations from the intervaginal space and from the interior of the vitreous were negative. Two Esmarch tubes were inoculated from the intervaginal space and two others from the interior of the vitreous One of each proved positive ; in that from the intervaginal space the staphylococcus pyogenes aureus was isolated ; in that from the interior of the eye, a non-pathogenic coccus. The search for bacteria in the tissues proved valueless on account of the overgrowth of the specimen by a budding fungus.

Anatomical Examination : The cornea and sclera are normal. The iris is moderately infiltrated ; there is a total adhesion between its posterior surface and the anterior lens capsule, with a consequent obliteration of the posterior chamber, and a retraction of the iris angle by the cyclitic membranes in the vitreous. The posterior portion of the ciliary body is detached from the sclerotic. The anterior portion is moderately, and the posterior markedly, infiltrated with round cells. The whole ciliary region of the vitreous is occupied by new-formed connective tissue, which drags on the neighboring structures. The anterior portion of the choroid is detached from the sclerotic with the ciliary body and is markedly infiltrated. The retina is totally detached and completely degenerated. There is a dense cellular deposit on its internal surface. An abundant accumulation of round cells is in the cup of the optic nerve. There is a slight degree of infiltration around the walls of the central blood-vessels. The nervous elements are greatly degenerated, more so than one would expect at such an early date.

Case 17 (Fig. 5).—Mrs R. "Phthisis after injury" (R).

History : Consulted Dr. Knapp at his office on December 2, 1890. R E had been injured seven years before. Patient could see for two years, and the eye was of its natural size till six weeks ago, when it inflamed. Condition : scar in the upper part of the cornea, cornea small, iris bulging, eyeball very painful ; S lost. *December 22d.*—Enucleation by Dr. H. Knapp at the Institute ; optic-nerve shrunken, atrophic.

Bacteriological Examination : Two cover-glass preparations and two Esmarch tubes were made from the intervaginal space and two others from the interior of the eye—all proved negative.

Anatomical Examination: The eye is typically phthisical. There is an old scar in the upper part of the cornea, a loss of continuity in the adjacent iris, and some disorganization of the upper part of the lens. The sclero-corneal junction is drawn inwards, giving evidence of the traction bearing on it. The iris is completely atrophic, and adherent to the posterior surface of the cornea, there being only a small free space between them below which is filled with an amorphous material. Its posterior surface is totally adherent to the lens. The posterior four fifths of the ciliary body and the choroid are completely detached from the sclerotic by the contraction of the cyclitic bands. There is some cellular infiltration of the ciliary body proper. The supra-choroideal space is filled with coagulated matter and extravasated blood-

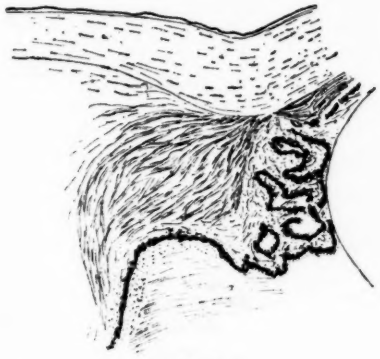

FIG. 5.

corpuscles. The retina is detached in a funnel shape and shows the usual degenerative changes. The optic nerve is atrophic. The whole ciliary region of the vitreous is filled with organized connective tissue, which, by its contraction, brings about the mechanical changes just described.

CASE 18.—R. H. "Panophthalmitis incipiens." Enucleation on January 19, 1891, by Dr. H. Knapp.

Bacteriological Examination: Cover-glass specimens from the interior of the eye and four Esmarch tubes inoculated from the intervaginal space and interior of the eye proved negative.

Anatomical Examination: There is a perforating wound through the cornea and lens, the defect in both being filled by densely infiltrated and escaping vitreous. The wound in the cornea occu-

pies more or less its centre; no iris prolapses through it. The neighboring cornea shows only a very moderate degree of infiltration. The whole uveal tract is very much swollen and infiltrated with round cells; these changes are more pronounced anteriorly, especially in the iris. Both its surfaces are covered by a thick deposit of a fibrino-purulent character. A similar deposit is found on the surface of the ciliary processes. The retina is infiltrated, there being also a dense cellular deposit on its internal surface. The optic nerve is moderately infiltrated. The lens is more or less disorganized, and is partially divided into two segments by the escaping vitreous; the lens fibres are swollen, and between them a moderate number of lymphoid cells are to be found. The vitreous, especially in its anterior portion, is one mass of pus cells.

Case 19.—A. B. "Perforating wound of the cornea" (L). Enucleation on January 21, 1891, by Dr. H. Knapp.

Bacteriological Examination: Two Esmarch tubes were inoculated from the intervaginal space, and two from the interior of the eye—all proved negative.

Anatomical Examination: There is an open wound in the cornea, extending across it from one ciliary rigion to the other, through which the lens has escaped. In the wound gap lie iris, lens capsule, and vitreous. The injury must have been very recent, for there are as yet no inflammatory changes, except in the prolapsed iris, which shows a more or less marked cellular infiltration. The other structures are normal.

Case 20.—D. T. "Purulent cyclitis; foreign body" (R).

History: December 12, 1890, whilst hammering a piece of steel something struck the patient's right eye. Lachrymation and pain for several days. *December 22d*, great swelling and discharge, which gradually subsided. *January 19th*, patient brought by Dr. A. Duane to Dr. Knapp's office. Condition: ciliary injection; iris greenish-brown; posterior synechiæ—T½; no tenderness on pressure. Dr. Duane had at first noticed a wound in the ciliary region (lower portion) surrounded by a gray substance; vitreous hazy; disk normal, though veiled. *January 23d*, enucleation at Institute.

Bacteriological Examination: Negative.

Anatomical Examination: A chip of iron, irregular in shape, was found imbedded in the ciliary region, surrounded by a mass of exudation. There is a perforating wound through the sclerotic,

choroid, and retina just posterior to the ciliary body; the wound is filled by densely infiltrated vitreous. The iris is intensely swollen and very much infiltrated with round cells; there is a dense fibrino-purulent deposit on both its surfaces. The ciliary body is likewise very much infiltrated, there being a deposit of a similar nature on the surface of the ciliary processes. The choroid is markedly infiltrated; the supra-choroideal space is at places occupied by a cellulo-fibrinous exudation. The retina is detached and deeply infiltrated. The optic nerve shows no marked changes The lens is normal. The whole anterior portion of the vitreous is most densely infiltrated with round cells.

CASE 21.—C. M. "Cyclitis after injury" (R).

History: May 27, 1891, whilst working on a piece of iron a chip entered the patient's right eye. No immediate inflammatory reaction followed, S being preserved till June 1st. *June 6th*, came to Dispensary. Condition: wound in the ciliary region (below and outwards); iris dull and swollen; anterior chamber dull, hypopyon; V = $\frac{1}{6}$. Enucleation by Dr. R. O. Born.

Bacteriological Investigation: Negative.

Anatomical Examination: There is a wound just posterior to the ciliary body, with the usual inflammatory changes in the neighborhood. The cornea and the sclerotic (except at the wound) are normal. The iris is swollen and somewhat infiltrated. The ciliary body is moderately infiltrated and there is an abundant cellular deposit on the surface of the ciliary processes near the wound. The choroid is abundantly infiltrated with round cells, which mostly occupy its internal layers. Half-way between the optic nerve and the wound there is a large, partly cellular, partly hemorrhagic exudate, between the sclerotic and choroid, which completely raises up the latter. The retina is densely infiltrated; there is an abundant cellular deposit on its internal surface. Optic nerve and lens normal. The anterior chamber is filled with a fibrino-purulent exudate with round cells and blood.

CASE 22.—A M., æt. nine years. "Cyclitis after injury" (L).

History: May 19, 1891, patient brought to Dispensary; four days before he had been cut in the eye by a piece of tin thrown by another boy. Condition: Perforating wound at sclero-corneal margin (temporal side); iris impacted, some mucus hanging from it: blood in anterior chamber; V = $\frac{1}{60}$; comparatively free from pain and discomfort till the beginning of June, when the eye became inflamed. *June 10th*, patient returned, presenting a typi-

cal picture of irido-cyclitis; intense ciliary injection; iris dull; purulent mass, filling the pupillary area; eyeball very tender; other eye still normal; enucleation urgently advised. *June 11th*, enucleation by Dr. R. O. Born.

Bacteriological Examination: Two Esmarch tubes inoculated from the intervaginal space; two from the interior of the vitreous. The former proved negative; from one of the latter the staphylococcus pyogenes aureus was isolated.

Anatomical Examination: There is a perforating wound at the sclero-corneal margin, in which the iris is incarcerated; the neighboring cornea and sclerotic show a most pronounced cellular infiltration. The iris, both in the wound and elsewhere, is densely infiltrated with round cells; it is applied to the posterior surface of the cornea; the iris angle is retracted. The posterior four-fifths of the ciliary body and anterior portion of the choroid are detached from the sclerotic by an abundant exudation into the supra-choroideal space, aided by the contraction of the ciliary bands and membranes; they are both intensely infiltrated, especially the choroid near the optic-nerve entrance. The retina is totally detached, and participates in the general cellular infiltration. The optic nerve is markedly infiltrated with round cells; there is only a slight infiltration of its sheath. The ciliary nerves, in their passage through the sclerotic, show here and there a slight infiltration of their sheaths. The lens is displaced forward. The anterior chamber is obliterated by the pushing forward of the lens and iris. The posterior chamber and zonula are filled with a partially organized cellular exudation. The vitreous is most abundantly infiltrated—there being in its anterior portion some organization into bands, which drag on the neighboring structures. There is also an abundant exudation between the retina and the choroid.

CASE 23 (Fig 6, on plate at end of paper).—B. M., æt. thirty-one years. "Cyclitis after injury" (L).

History: June 20, 1891, patient received a wound in the eye with a prong. Dr. Fenfield was called in, and he sutured the wound; the sutures were removed four days later. Hitherto there had been no signal discomfort; the eye then inflamed, S being gradually lost. *June 27th*, came to Dispensary. Condition: perforating wound about $\frac{1}{3}''$ long in the ciliary region (below), running in an antero-posterior direction; intense circumcorneal injection; some chemosis; iris dull, sluggish; withstands atropine; anterior chamber a little hazy; by oblique illu-

mination white flocculent masses could be seen floating in the vitreous; S = $\frac{1}{\infty}$; eyeball very painful; a good deal of lachrymation. *July 1st*, enucleation by Dr. J. H. Shorter.

Bacteriological Examination: One agar and two gelatine Esmarchs; each was planted from both the optic-nerve sheath and from the interior of the eye. The former proved negative; from one of the gelatine tubes from the latter a pure culture of the staphylococcus pyogenes aureus was obtained.

Anatomical Examination: There is a perforation posterior to the ciliary body, passing through the sclerotic, choroid, and retina into the vitreous. In the wound gap there is an incarceration of the most anterior portion of the choroid and of the posterior extremity of the ciliary body. These, as well as the neighboring sclerotic are richly infiltrated with round cells; the ciliary nerves passing through this region show, here and there, some lymphoid exudation into their sheaths. The whole uveal tract is markedly infiltrated, and in the substance of the choroid near the optic-nerve entrance there are several hemorrhagic extravasations. The choroid is partially separated from the sclerotic by an abundant cellular exudation into the supra-choroideal space. The retina is enormously infiltrated; it is, at places, partially detached from the choroid by an exudation into the subretinal space; this has here and there partially organized, reuniting both structures in a mass of connective tissue. The optic nerve is moderately infiltrated. The lens is normal. The anterior and posterior chambers are filled by a fibrous exudate, in the meshes of which we find numerous red and white blood corpuscles. The zonula and lower portion of the posterior chamber are occupied by an abundant accumulation of lymphoid cells. There is a partially organized exudation on the surface of the ciliary processes. The internal surface of the retina is likewise the seat of a dense cellular deposit. The vitreous is profoundly altered; it is split into numerous fibrillæ, especially towards its periphery (Fig. 61; between them round cells are found in moderate numbers, excepting in one or two places, where they are accumulated into foci. We also find the formation of open spaces in the interior of the vitreous.[1]

Case 24.—J. R., æt. twenty-five years. "Phthisis after injury" (R).

History: October 30, 1891: eye injured nine years before in an explosion of a gun cartridge. Since then repeated attacks of

[1] See *Beiträge zur Anatomie des Auges.* Emil Berger, Wiesbaden, 1887.

inflammation. Condition: ciliary injection; hypopyon; tenderness on pressure; S = o. Enucleation by Dr. H. Knapp.

Bacteriological Examination: Two Esmarch tubes each were inoculated from the intervaginal space, from the vitreous, and from the exudation in the anterior chamber. All proved negative.

Anatomical Examination: No evidence of a scar can be made out. The cornea is partially vascularized. The iris and ciliary body show a relative increase of their connective-tissue elements; the ciliary muscle is very much atrophied; they are both richly infiltrated with round cells. The pupillary margin is adherent to the anterior lens capsule; the iris angle obliterated. The choroid also is atrophic, with a relative increase in its connective tissue elements. The retina is totally detached, and shows the usual degenerative changes. The optic nerve is atrophic. The lens is cretaceous. In the vitreous there is some formation of cyclitic membranes.

CASE 25.—A. G., æt. twelve years. "Panophthalmitis incipiens" (R).

History: November 1, 1891: patient brought to Dr. Knapp's office; eighteen hours before, the right eye had been struck by a piece of glass. Condition: vulnus corneæ perforans suppurativum; corneal wound infiltrated; no chemosis; pain less than the day before; S = o. *Nov. 2d*, swelling of conjunctiva; slight protrusion of eyeball. Other eye (L), V = $\frac{20}{20}$. Sent to Institute, where the eye was enucleated the same afternoon.

Bacteriological Examination: Two Esmarch tubes each were inoculated from the intervaginal space, from the vitreous, and from the exudation in the anterior chamber; all proved negative. Cover-glass preparations from both the exudation in the vitreous and that in the anterior chamber showed numberless cocci.

Anatomical Examination: There is a perforating wound of the cornea with prolapse of iris; the lens has escaped. All the structures of the eyeball are most densely infiltrated with pus cells, showing an intense purulent panophthalmitis. Especially noticeable is the infiltration of the ciliary muscle and of the suprachoroideal space. An enormous cellular deposit on both surfaces of the iris and on the ciliary processes. The optic nerve is moderately infiltrated around the central blood-vessels. The vitreous is one mass of pus cells.

CASE 26.—P. M., æt. thirty-seven years. "Purulent cyclitis; foreign body" (R).

History: November 3, 1891, three weeks before, patient injured by a piece of iron which entered his right eye. Since then the eye has been inflamed. Condition: there is a wound running transversely across the cornea; traumatic cataract; purulent cyclitis. Enucleation by Dr. H. Knapp.

Bacteriological Examination: Two Esmarch tubes were inoculated from the interior of the vitreous. Result, negative.

Anatomical Examination—Macroscopical Appearance: After the inoculation of the Esmarchs the eyeball was opened by an equatorial section. The ciliary region was filled with creamy pus; the retina around the optic-nerve entrance was swollen and infiltrated. A piece of iron, 2‴ in length was found at the bottom of the eye, surrounded by pus. No microscopical examination was made.

CASE 27.—A. B., æt. ten years. "Cyclitis after injury" (R).

History: November 13, 1891, injury four months before; no inflammation; S lost; traumatic cataract; total detachment of the retina; eyeball shrinking. Enucleation by Dr. H. Knapp.

Bacteriological Examination: Two Esmarch tubes each were inoculated from the intervaginal space and from the interior of the vitreous. Result, negative.

CASE 28.—W. M., æt. eighteen years. "Panophthalmitis incipiens" (L).

History: December 8, 1891, eye injured by a piece of steel, which flew into the patient's eye whilst he was walking through the workshops at Cornell University. A local physician immediately removed some protruding iris. *Dec. 10th*, seen by Dr. Knapp at his office. Condition: traumatic cataract; chemosis; exophthalmos; cornea and iris clear. Sent to Institute. *Dec. 11th*, same condition; besides, anterior chamber full of blood, masking iris; yellowish reflex from the lens. Enucleation by Dr. H. Knapp. Orbital tissues much inflamed; cut end of optic nerve congested.

Bacteriological Examination: Two Esmarch tubes each were inoculated from the intervaginal space and from the interior of the eyeball; all proved negative. In cover-glass preparations from the vitreous, however, groups of cocci were demonstrated.

Anatomical Examination—Macroscopical Appearance: The eyeball was opened by an equatorial section (immediately after making the cultures). The vitreous was full of flakes of pus and blood; the pus was thicker toward the posterior pole of

the eye, where a wedge-shaped piece of iron, $\frac{1}{2}'' \times \frac{1}{3}''$, was found imbedded in the sclerotic

CASE 29.—O. I, æt twelve years. "Panophthalmitis incipiens" (R).

History: March 9, 1892, patient had been shot in the eye with bird-shot a week before. Condition: a wound in the upper portion of the ciliary region; iris prolapsed; wound suppurating; picture of incipient panophthalmitis. Enucleation by Dr. H. Knapp.

Bacteriological Examination: Two puncture cultures made from the exudation in the vitreous. Negative result.

Anatomical Examination—Macroscopical Appearance: The eye was opened by an equatorial section. The vitreous was full of blood; along its upper portion there was a streak of exudation marking the track of the foreign body. This was not found but was evidently imbedded in a mass of exudation at the posterior pole (this was not disturbed, so as not to alter the relations of the different structures. (No microscopical examination was made.)

CASE 30.—F. B., æt. thirty-six years. "Purulent cyclitis" (L).

History: Dec. 12, 1890, patient struck in the eye by some portion of a harrow which he was repairing. Seen by Dr. Knapp half an hour later. Condition: irregular wound in the cornea; in the anterior chamber, at the periphery of the iris, there was a black foreign body, 1 *mm* in length. Sent to Institute and put to bed. *Dec.* 23*d*, pain all night; at 2 P.M., circumcorneal injection; foreign body at lower edge of the iris partially covered by pus; fundus dull. At 5 P.M., iris distinctly tremulous and sunken back; fundus still to be illuminated, but very dull; Tn; F good; $V = \frac{1}{200}$. Operation by Dr. H. Knapp. Section of cornea with a lance-shaped knife as for iridectomy; foreign body removed from the iris with a blunt, curved hook; iris replaced; prolapse of vitreous, cut off. No reaction followed. *Jan* 11*th*, Tn; F normal; $V = \frac{5}{200}$. Discharged. Eye remained free from inflammation but a cataract developed. *April* 25, 1892, after much hesitation Dr. Knapp finally decided to attempt the extraction of the lens. The extraction was difficult and accompanied by considerable loss of healthy vitreous, the lens being finally delivered by external manipulation, after the introduction of instruments had proved ineffectual. No imme-

diate reaction. On the fifth or sixth day, however, a slow-going form of inflammation broke out, which after an insidious course of five to six weeks, with temporary improvements and exacerbations, gradually developed into a typical case of irido-cyclitis purulenta. *June 2d*, enucleation by Dr. H. Knapp.

Bacteriological Examination: One gelatine tube inoculated from the intervaginal space, two from the exudation in ciliary region. The former proved negative; in one of the latter developed a pure culture of the staphylococcus pyogenes aureus.

Anatomical Examination—Macroscopical Appearance: Eyeball opened by an equatorial section; lower portion of ciliary region occupied by a purulent exudation; posterior portion of globe normal.

Before laying down my pen I beg to express my gratitude to my esteemed teacher, Prof. H. Knapp, for his kindness in allowing me the free use of his laboratory and in supplying me with the greater part of the material on which these investigations were conducted. I am still further indebted to him for the invaluable advice and sound criticism which he was always ready to bestow on my work. My thanks are also due to my colleagues at the N. Y. Ophthalmic and Aural Institute, for the material with which they supplied me,—Drs. Born, D'Oench, Shorter, and especially to Dr. W. A. Holden, for the drawings with which he has illustrated this paper.

SUPPLEMENT.

Since the handing in of the preceding paper, a negative experiment with regard to the infectious origin of a cyclitis in an injured eye, sympathetic ophthalmia having broken out in the other, has been reported in these ARCHIVES (xxi., 3), by Dr. Randolph, of Baltimore. This, together with the negative results previously obtained by himself and other observers, leads him to conclude against the bacteriological origin of the affection, as advocated by Deutschmann. I can find no reason in his paper to alter my conclusions as to the infectious origin of the cyclitis in question. The value of this negative result is somewhat lessened by the following facts: (1) The length of time which had elapsed since the injury

—the eyeball being enucleated two and a half months later, it being very possible that the micro-organisms had already been destroyed by their own products, notwithstanding the fact that the process was still active at the time of the enucleation; (2) the limitation of the bacteriological investigation to the iris and aqueous chambers; (3) the absence of a histological or of a histo-bacteriological examination.

The series of negative results of different observers, quoted by Dr. Randolph, are of undoubted value, but positive results, even if fewer in number, have a much greater importance. In dealing with these, Dr. Randolph only mentions Deutschmann's, ignoring those of Secondi (*Annali di Ottalmologia*, xx., 3), and of Schiess-Gemuseus (*Bericht der Augenheilanstalt in Basel*, 1891); he also fails to take into account the experiments of Knapp and Leber, quoted above, on the septic or aseptic condition of wounds and the instruments producing them, and of foreign bodies lodged in the interior of eyeballs, in relation to their liability to produce inflammation and sympathetic ophthalmia.

With regard to the purely theoretical arguments advanced by Dr. Randolph against the staphylococcus pyogenes aureus in particular, they fall to the ground before the positive results quoted, as well as those detailed in this paper.

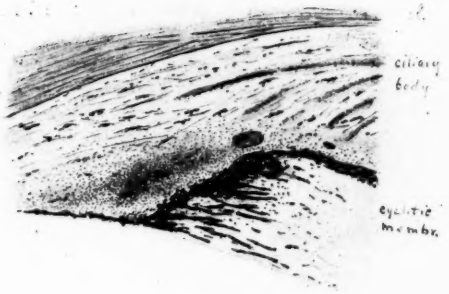

Fig. 4.

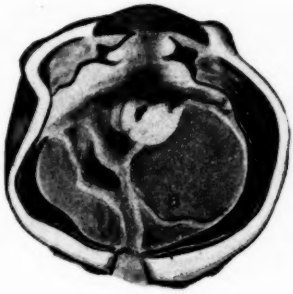

Fig. 2.

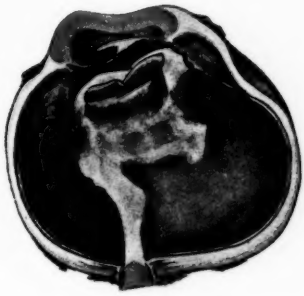

Fig. 3.

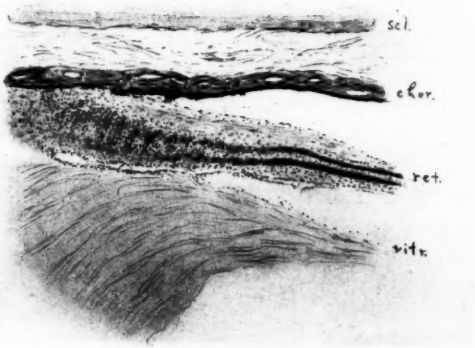

Fig. 6.

Holden, del.

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EMBOLISM OF ARTERIA CENTRALIS RETINÆ.

By JNO. M. FOSTER,

CLINICAL INSTRUCTOR OPHTHAL. AND OTOL., MED. DEPT. UNIVERSITY OF DENVER.

(*With two figures in the text.*)

THE following is quite an interesting case of embolism of the arteria centralis retinæ which occurred in a gentleman 29 years of age who gave a history of inflammatory rheumatism accompanied by endocarditis, which resulted in mitral stenosis and regurgitation.

At the time of the stoppage of the artery the patient was making his toilet, and immediately noticed that he had lost the sight of his left eye. There was no pain or any sensation whatever. The sight was reduced to the bare perception of light; the pupil reacted in sympathy with the right, but when the latter eye was covered, it dilated immediately and remained passive. An ophthalmoscopic examination was made within two hours of the occurrence of the embolism, and presented the picture shown in Fig. 1. Particularly noticeable was the dense grayish-white effusion that marked the macula lutea and optic disk, rendering all details of this portion of the fundus invisible. The arteries were extremely attenuated and almost invisible when they emerged from behind the cloudlike veil. There was no indication of interruption of current or pulsation, but a short distance below the effusion the blood-vessels were again interrupted for a small space by the grayish covering. On the third day following the embolism, the effusion became more pronounced, and whitish striations radiated from the region of the macula in a particularly striking manner. At this time it was found that there was absolutely no perception of light, even the strongest rays thrown into the eye not being recognized.

This increase in the already dense effusion suggested the absorbent treatment that was undertaken, *viz.*, iodide of potash internally and the application of the artificial leech to the left temple every fourth day, with confinement to a darkened room. In ten days clearing commenced at upper and outer edge of disk and continued without change in vision until the thirty-third day, at which time there was a faint but unmistakable perception of light, and the cloud has become so thin that the veins could be distinctly traced to the centre of the disk. The effusion over the macula had assumed a pinkish cast, but no details could be made out. Fig. 2 represents the appearance of the fundus on April 2d,

FIG. 1.

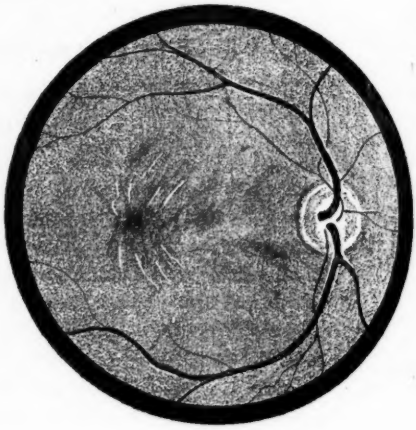

FIG. 2.

the forty-ninth day. Vision improved to differentiation between fingers closed or held apart near the eye. Since this time the sight has not improved.

The points that attract the attention are the rapidity with which the cloud formed, its great opacity and subsequent increase in density, its absorption, and the silvery-like lines and reddish mottling around the macula that remains, and the question with it, as to whether or not the condition was influenced by the treatment.

MICROSCOPIC EXAMINATION OF A CASE OF TYPICAL INFERIOR COLOBOMA OF THE IRIS.

By WARD A. HOLDEN, M.D., New York.

(*With six figures.*)

THE specimen in Müller's fluid was sent to the laboratory of the Ophthalmic and Aural Institute through the kindness of Dr. Geo. F. Carey. It was obtained at the autopsy of E. V., æt. fifteen months, dead of broncho-pneumonia. Besides the fact that an inferior coloboma of the iris was noticed in each eye, there was no record of a clinical examination.

The ball was of regular form and normal size. It was first divided by an equatorial section. There was a narrow coloboma of the iris reaching apparently to the ciliary body, but no other macroscopic abnormalities. The anterior segment was cut with a microtome in sections in and parallel to a plane passing obliquely from below upward through the head of the ciliary body and the centre of the ball, so that transverse sections of the ciliary body and the margins of the coloboma were obtained. The posterior segment was cut partly in frontal sections, partly in sagittal sections through the nerve.

Anatomical Description.—There was no coloboma of the nerve sheath, and the vessels ran in the middle of the nerve, dividing in the centre of the papilla. The retina, pigment epithelium, and choroid showed no cleft In the posterior portion of the ciliary body a cleft was seen in the pigment epithelium and the pars ciliaris retinæ, and this cleft continued along the apex of a ciliary process, being continuous anteriorly with the coloboma of the iris (Figs. 2–6.) The connective-tissue, mesoblastic portion of the ciliary process filling the space, showed no signs of previous in-

flammation. At the ciliary margin of the iris the cleft in the uveal layer was wider but was bridged over by the mesoblastic layer for some distance, when this latter failed also. The zonula was continuous and well developed, showing a considerable number of nuclei. Just at the head of the ciliary body where the cleft was wide, branched cells of the mesoblastic layer were in connection with similar cells among the fibres of the zonula. No trace of the sphincter pupillæ was found in the walls of the coloboma. In the pupil proper the sphincter was well developed, and running from the minor circle, which here only was marked, were nucleated fibres and tracts of spindle cells extending out upon the lens capsule (persistent pupillary membrane). The posterior capsule was normal.

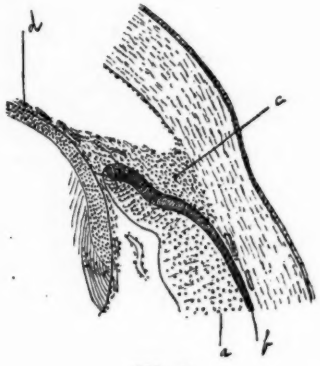

FIG. 1.

BEGINNING OF IRIS DEVELOPMENT IN PIG EMBRYO.

a, retina; *b*, pigment epithelium—together forming epiblastic fold; *c*, mesoblastic layer of iris; *d*, pupillary membrane.

Examining the two epiblastic layers more closely, it is seen that the pigment epithelium is very thin near the cleft. The pars ciliaris retinæ is normal over the ciliary body. In the iris, however, its continuation, the posterior layer of the uveal portion, is unpigmented for some little distance from the margins of the coloboma. The ciliary process in which the cleft lies is larger than the others. The margins of the cleft in most sections are turned outward.[1]

[1] A few elementary statements in regard to development may be admissible here. The primary optic vesicle is an epiblastic layer several cells deep. With the involution of the lens, the anterior and inferior wall of the primary vesicle

In our case the cleft in the secondary optic vesicle has closed normally in the posterior half of the ball, but from near the æquator forward there has been an interruption, possibly due either to the persistence of mesoblastic tissue in the cleft or to an inflammation in the mesoblastic tissue without, which has prevented the junction. No evidences of inflammation, however, can now be found. The cleft in the anterior portion of the vesicle from which the iris develops has been bridged for a short distance by the mesoblastic tissue that pushes out here. This tissue not having the supporting epiblastic layers along which to extend, has ceased to develop. The fact that at the periphery of the coloboma the mesoblastic layer of the iris is continuous with mesoblastic cells beneath it (Fig. 3) shows that the mesoblastic portion of the iris has pushed out here and has united with the vascular sheath of the lens in front of the epiblastic portion as is usual. The epiblastic portion not developing in the cleft, the mesoblastic portion has remained without forming a complete pupillary membrane here, and no remains of pupillary membrane are found in the coloboma, although they appear in the pupil proper.

The ciliary processes are probably produced by an excessive development of the walls of the secondary optic vesicle which throws them into folds, which latter become filled

is pushed inward until it lies in contact with the posterior wall, thus forming the secondary optic vesicle, which has a circular opening anteriorly, occupied by the lens, and a cleft below, the margins of which are formed on either side by the fold in the vesicle wall. Through this cleft pushes vascular tissue from the mesoblast without. This vascular tissue forms the vitreous, the fibro-vascular sheath of the lens, and later the suspensory ligament, and the vessels of the retina.

The folded margins of the cleft close from behind forward, each layer becoming continuous, leaving no trace of the junction.

The anterior portion of the secondary vesicle lies in contact with the lens, and as the ball enlarges faster than the lens, the epiblastic fold turns inward, and a layer of mesoblastic tissue covers its anterior surface and becomes continuous with the anterior vascular sheath of the lens, forming the pupillary membrane; the epiblastic fold and mesoblastic covering making up the iris (Fig. 1).

In the posterior portion of the ball the two layers of the secondary vesicle wall, being each several cells deep, differentiate, and the outer (lateral), diminishing to a single layer, becomes pigmented, forming the pigment epithelium, which lines the entire uveal tract. The inner (medial) layer becomes thicker in the posterior portion of the ball, forming the retina. In the ciliary body which develops later it forms the single layer of unpigmented cells called the pars ciliaris retinae. On the posterior surface of the iris it forms a single layer identical with the pars ciliaris, except that it becomes pigmented.

with mesoblastic tissue. The development in an antero-posterior direction produces the iris, that in a transverse direction produces the meridional folds of the ciliary processes.

In our case the apex of the ciliary process is formed by the cleft, the weak point in the epiblastic layers, and this ciliary process is higher than the others, probably for the reasons that the margins of the cleft have been freer to develop than the continuous portion of the wall.

The inferior coloboma of the iris, with which is often associated coloboma of the ciliary body, choroid, and nerve sheath, was for a long time considered simply the result of arrested development. Coloboma in other directions, which is never associated with coloboma of the choroid, was explained in various ways. Recently the process in coloboma not downward has been considered to be the same as that producing total absence of the iris, the coloboma being called atypical, or properly, a partial irideremia.

Attention was again called to this subject when Deutschmann[1] described the eye of a rabbit with coloboma of the choroid, showing the results of severe inflammation which had occurred in the mesoblastic tissue at a time when the retinal cleft was closing, the signs of inflammation being particularly marked at the sclero-corneal margin, causing a coloboma of the iris.

Some of the cases studied since this time have shown evidences of intra-uterine inflammation, some have not. Manz,[2] in an eye with lateral coloboma, found a thin, poorly developed choroid. Rindfleish,[3] in eyes with irideremia, found signs of inflammation and ulceration at the sclero-corneal margin, and he supposed an adhesion between the lens and the cornea to be the cause of the partial non-development of the iris. Plange[4] assumes an obstruction in the vascular sheath of the lens or a partial adhesion between the lens and cornea as the cause of atypical coloboma. Hess[5] has found in several cases of coloboma a fine bundle of connective tis-

[1] *Zehender's klin. Monatsbl.*, xix., p. 101.
[2] *Report Seventh Internat. Oph. Congr.*, Heidelberg, 1888.
[3] *Graefe's Archiv*, xxxviii., 1, p. 191.
[4] *Archiv f. Augenheilk.*, xvi., p. 205.
[5] *Zehender's klin. Monatsbl.*, xxx., March; and *Graefe's Archiv*, xxxiv., 3.

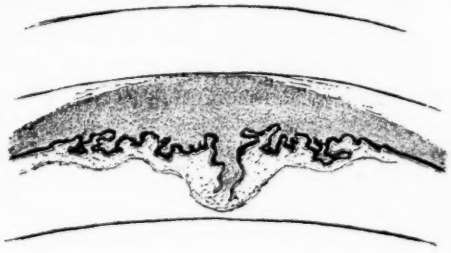

FIG. 2.

Post. portion of ciliary process.

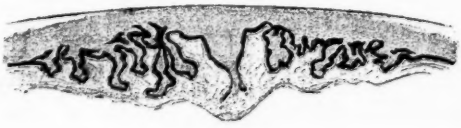

FIG. 3.

Ant. portion of ciliary process.

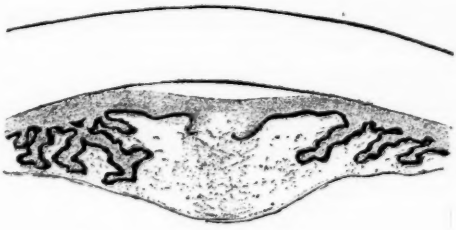

FIG. 4.

Periphery of iris.

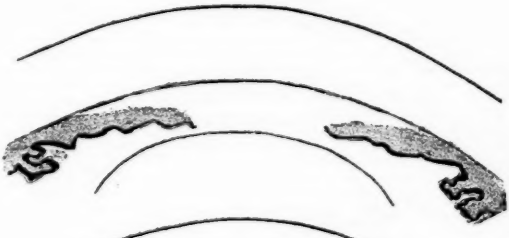

FIG. 5.

Coloboma of iris.

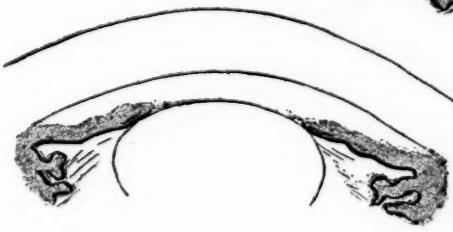

FIG. 6.

Pupil proper.

sue running from the optic disk to the posterior pole of the lens and then toward the equator, being finally inserted into the choroid at the sclero-corneal margin. This, in his opinion, furnished a mechanical obstruction to the growth of the iris.

In many colobomatous eyes there are remains of mesoblastic tissues which have not undergone the usual absorption, such as deposits on the lens capsule, persistent hyaloid artery, or pupillary membrane, etc., but their relations to the coloboma are not clear.

By some the genesis of atypical coloboma is thought to be different from that of typical. By others the process is thought to be the same in both, but occurring more frequently downward since there being already a cleft here, a coloboma is produced much more readily than in other locations.

In our case the fœtal cleft did not close completely in its anterior half, but the cause of its non-closure is not revealed by microscopic examination. If the cause were an inflammation of the mesoblastic tissue, this was so slight that after fifteen months of extra-uterine life no trace of it can be discovered.

A REMARKABLE CASE OF PSEUDO-TRACHOMA.

By Dr. RICHARD GREEFF,

ASSISTANT TO THE UNIVERSITY EYE-CLINIC IN BERLIN.

Translated by Dr. CHARLES ZIMMERMANN, Milwaukee, Wis.

(*With Tab. I., of vol. xxiv., Germ. Edit.*)

BEFORE and at the time of the last international medical congress at Berlin, a peculiar and especially marked case of a conjunctival affection was treated at our policlinic. Prof. Schweigger intended to show it to the section of ophthalmology at the session, in which the discussion on *Trachoma* was in order, thinking that a living case with a doubtful diagnosis, despite its marked clinical features, would serve best to elicit the opinion of our colleagues and lead to subsequent discussions of the subject. Unfortunately the demonstration could not take place for want of space. The case, interesting at that time, became still more remarkable by its course and its speedy, complete, and spontaneous recovery. I took a photographic picture of the diseased eye by flashlight before and after recovery.

Our case is as follows: A. N., fourteen years old, of Berlin, came into the policlinic on July 22, 1890, stating that his left eye had been swollen for several months and had become "smaller," with lachrymation and a burning sensation in the eye. His eyes had always been healthy, and none of his family members nor any of his schoolfellows had had any eye disease (as proven by later inquiries). He never had left the city. Lately his condition had become worse. He never noticed anything on his right eye Otherwise he feels perfectly well. Both lids of the left eye,

especially the upper one, show a moderate thickening and redness, and it hangs farther down than the right one and covers the upper corneal margin even when he opens his eyes wide. Cornea and the parts around it perfectly clear and normal. Refract. E. V= $\frac{6}{6}$. Slight injection of ocular conjunctiva, no pericorneal injection. The sclero-corneal junction without any changes. Moderate lachrymation and photophobia. On eversion of the upper and lower lids the retrotarsal fold bulges as an intensely swollen and red mass. *The conjunctiva of both lids from fornix to ciliary border is totally and densely covered with numerous miliary granulations, projecting in the form of hemispheres from the swollen conjunctiva.* The conjunctiva at the middle portion of the upper tarsus shows also very many such granulations. The granules often are of considerable size, to 3*mm* in diameter, and form horizontal chains like frog-spawn. They are grayish-red and very little transparent; the mucous membrane between them is reddened.

Right eye perfectly normal. Retrotarsal fold not in the least swollen, conjunctiva smooth and of normal lustre. Only at the temporal corner of the lower lid are a few small papillæ of the size of a pin's head, as often found in the normal mucous membrane. The lymphatic glands of the body are not diseased, but the left pre-auricular gland is moderately swollen. No pathological changes of other organs, especially no trace of tuberculosis. The boy is of robust, healthy appearance. His hygienic conditions at home are good.

The diagnosis was doubtful. Although it looked at first like a typical case of trachoma, as we seldom see it in Berlin, it had some different features. Trachoma is chiefly an endemic infectious disease, and occurs only in certain regions. Trachoma is not at all a common affection in Berlin. Among the great number of patients of our clinic, recent trachoma is very rare, and can be traced almost always to a direct importation from Eastern Prussia, Poland, Russia, etc. This was not possible in our patient, neither his relations nor schoolmates being affected, and it was remarkable that neither they nor his other eye became infected, as the affection had existed for quite a long time, without any precautions being taken.

Foerster and others doubt the infectiousness of trachoma; on the other hand Schmidt-Rimpler proved the transportation of trachoma from patient to patient, from house to house

in Hesse. Besides, the eye trouble and inflammatory appearance were too slight for trachoma. It could not be follicular conjunctivitis on account of the clinical aspect. Schmidt-Rimpler, distinguishing sharply both forms, characterizes follicular conjunctivitis as follows[1]:

"The follicles are never as numerous as the granulations, a few are found mostly in the external corner, or in the anterior portions of the fornix; they hardly ever reach the anterior tarsal portion. At the upper lid they are entirely wanting. Occasionally a few small follicles are seen at the posterior portion or external angle of the tarsal mucous membrane. The prominences in follicular conjunctivitis frequently are transparent, have a vesicular appearance, and have the size of a pin's head." Foerster[2] expresses himself in a similar manner. The follicular prominences never attain the size of large trachoma-granules, are not gray, but transparent, reddish, often very numerous at the lower retrotarsal fold, which is their place of predilection, and they never occur on the upper lid. Both descriptions are inapplicable to our case. The so-called spring catarrh (Saemisch) may be excluded, since the corneal margin did not show the least changes. The course, the absence of relapses up to date, completely confirm this assertion. The first appearance suggested the diagnosis "Trachoma." I have seen large *and numerous granulations only in trachoma regions*, in the eye-clinic of my former teacher Schmidt-Rimpler in Marburg, and in the policlinic of Prof. Gama Pinto in Lisbon, where the granulations become wonderfully exuberant under the southern sun.

A small piece of retrotarsal fold with a few trachoma-granules on it was excised under the influence of cocaine for microscopical examination, hardened in absolute alcohol and cut in sections at right angles to the surface (Fig. 3). Each section contains 2–3 large trachoma follicles, which might be called "lymphomas." They are pretty sharply differentiated from the loose surrounding tissue, and show a well marked membrane of connective tissue. The folli-

[1] *Augenheilkunde und Ophthalmoscopie*, 5th edition, p. 415.
[2] *Breslauer Aerztliche Zeitschrift*, 1888, p. 3.

cles are composed of closely crowded large lymph-cells and have a very tender and hardly noticeable stroma. The peripheral lymph cells are smaller and more densely crowded. In the neighborhood of the follicles there is a moderate infiltration of the tissue with leucocytes. According to Saemisch[1] the follicle is separated from the stroma of the conjunctiva by a membrane of connective tissue, which is wanting in trachoma granules. This anatomical difference, however, does not always hold good (Schmidt-Rimpler, Mandelstamm,[2] Raehlmann[3]).

No examination for micro-organisms was made, since we are not yet able, to determine the diagnosis from a bacteriological standpoint. In order to keep the clinical picture for a demonstration, the treatment was expectant and very mild : cold applications, instillation of a $\frac{1}{2}$ % solution of sulphate of copper, and hygienic measures. After several weeks the inflammatory symptoms not having abated and the follicles remaining unchanged, the attempt was made in the policlinic, to remove the contents of the follicles by squeezing the lid between the thumb and forefinger. The patient being very obstinate, very little was effected. The boy had so little taste for this kind of treatment that he did not return, even when asked to do so. In April, 1891, I finally succeeded in seeing him again. His mother stated that she put the drops into the boy's eyes for a while, morning and night, and that the disease had gradually subsided after causing only moderate trouble for a few weeks. Externally nothing abnormal could be seen on the eye. The lids of both eyes appeared perfectly normal upon eversion, so that it was impossible to say which had been the affected one. In the outer angles of the lower lids of both eyes there were a few small prominences of the size of the point of a blunt pin,—the physiological small papillæ. There was no further trace of the enormous granulations.

The photographic picture taken in August, 1890, exhibited the condition at that time (Fig. 1). Fig. 2 shows the present state (April, 1891); Fig. 3 is the micro-photograph of a section perpendicular to the surface of the excised conjunctiva. Another picture (not given here), taken with an especially sensitive plate, showed

[1] *Handbuch der Augenheilkunde.*
[2] *Von Graefe's Arch.*, xxix., 1.
[3] *Von Graefe's Arch.*, xxix., 2.

the interesting phenomenon, that in the picture now lighter spots, not noticeable with the naked eye, were found in places on the smooth conjunctiva, where formerly the granules were situated. This fact is known from other parts of the body, that *e. g.* exanthema of measles, freckles, etc., are easily discernible in the photographic picture, even when hardly or not at all observable with the naked eye.

In this case we have a conjunctival disease presenting the picture of acute trachoma, with unusually large and numerous granulations, but moderate irritation. The clinical features did not admit of the diagnosis of follicular conjunctivitis. The granulations disappeared after about half a year without treatment and without leaving any traces. If we consider scars after cure as characteristic of trachoma, we can only make the diagnosis of follicular conjunctivitis in our case. Here we have to do with an atypical case: the spreading and great size of the granulations and the rapid disappearance are striking.

If we are allowed to draw conclusions from a special case, I would assert that follicular conjunctivitis and trachoma are to be considered as different forms of disease, and that the former is not, as some authors think, a milder and less marked kind of the latter. If this were a fact our case must be taken for trachoma and hardly for a mild and less marked species of it. But then such large and numerous trachoma granules would hardly ever spontaneously have disappeared so rapidly and completely. Our case thus shows that there are cases of follicular conjunctivitis without the usual clinical characteristics, presenting at first the aspect of acute trachoma, differing, however, very much from it by their course. Both eye diseases are so different in their effects, inasmuch as the former, even in the most severe degrees, is innocent, and disappears without leaving any traces, while the latter is obstinate, leading to shrinkage of the tissues, often with the most destructive consequences. It is probable that they are caused by entirely different morbid agents, the isolation and culture of which we have not yet been able to secure. At least this question is not yet definitely determined. Considering the similarity of the clinical picture of

both diseases at first, we might here take occasion to warn against the too early diagnosis of "Trachoma" and its too energetic treatment. "Trachoma," or Egyptian ophthalmia, unfortunately is diagnosed too often by physicians, especially when epidemics appear in barracks, schools, etc. If the innocent follicular catarrh is then wrongly treated with such energetic remedies as lunar caustic, it is no wonder that they produce violent reactions and perhaps scars. Special consideration ought to be given to the essay of Foerster,[1] who will not believe in the occurrence of epidemics of trachoma. He says: "There are no epidemics of trachoma any more; it does not seem to be improbable that formerly the spread of trachoma was of a more epidemic character. Very likely it was chiefly trachoma which raged among the Prussian troops and caused the most cases of blindness in the army. At present trachoma is an endemic disease, which in Silesia at least is becoming extinct. Even in the later stages of trachoma a too energetic treatment is out of place. Each trachoma-granule leaves a scar, and the abundance of granules easily leads to shrinking of the conjunctiva. Therefore everything ought to be avoided which might create such a shrinking process, especially Heisrath's method of excising and scraping the diseased mucous membrane." We saw several times in our clinic cases which had been operated on in this manner at Koenigsberg, exhibiting the saddest picture imaginable. In follicular conjunctivitis we have applied for quite a long time a two-to-three-per-cent. solution of biborate of sodium, according to Foerster's suggestion.

Our views in regard to conjunctival diseases with the formation of "granules" being at present rather confused and unsettled (almost every author has a different opinion), I thought it worth while to communicate this atypical, and for us very remarkable, case to my colleagues as a small contribution to the trachoma question. Its explanation and classification I prefer to leave to the ophthalmologists practising in trachoma regions.

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[1] *Breslauer Aerztliche Zeitschrift*, 1888, p. 1.

SHARP-CUT ECTASIA AT THE POSTERIOR POLE IN HIGH-GRADE MYOPIA.

By Dr. LEOPOLD WEISS, in Heidelberg.

Translated by Dr. B. Alex. Randall, Philadelphia.

(*With five figures on plate viii. of vol. xxiii., Germ. Ed., and one in the text.*)

THE so-called "posterior staphyloma" which is seen by the ophthalmoscope in such manifold form as a common finding in myopia, is not, as is well-known, an actual staphyloma in the sense that it is the expression of a sharply defined ectasia, the boundaries of which coincide with those of the whitish figure—the "conus"—which borders upon the nerve-head or surrounds it in annular form. When one follows the retinal vessels from the papilla over the so-called staphyloma, he clearly sees that there is no difference of level at the margin of the "staphyloma."

In contrast with this condition, there occurs—seldom indeed—in high-grade myopia a true posterior staphyloma, a pouched, sharp-cut ectasia at the posterior pole. At the margins of this actual staphyloma the retinal vessels are abruptly altered in course, since they must climb from the floor of the depressed area with a strong bend upon the steep wall, to reach the level of the general eye-ground.

In proof of this the following cases are reported, which have come to my notice in recent years.

Case 1.—A man of thirty-one, very near-sighted from earliest childhood, came March 11, 1885, because of a trivial injury. Vision could be raised only to $\frac{6}{60}$ left, and $\frac{5}{60}$ right, by —16 D; and vitreous opacities were found on both sides. The

ophthalmoscopic finding in the right fundus was very striking. Besides the choroidal disturbances and an annular "staphyloma" with most marked development to the temporal side, there appeared on the nasal side, rather more than a papilla-breadth from the white "ring-conus," a distinct dark curved line, broadest in the middle and narrowing up and down until it disappeared gradually temporalwards. With altered position of the mirror this curved line varied in breadth, as the shading of the steep wall of the ectasia became more or less distinct. The retinal vessels passing from the papilla across the area were sharply interrupted at the curved line, and showed marked parallactic movements in the indirect examination. No doubt remained that the dark curved line indicated the boundary of a sharply defined ectasia at the posterior pole of the eye—the shading on the steep nasal wall of the staphyloma giving rise to the dark line.

Case 2.—The second case was that of a young lady of twenty-four coming because of high near-sight, which was dated from early childhood. The vision was raised only to $\frac{6}{24}$ by—16 D. Just as in Case 1, the ophthalmoscope revealed a rather large annular conus, with a dark curvilinear band, doubled by an intervening bright line, rather more than a papilla-breadth to the nasal side of its margin. The retinal vessels passed with broken course and with marked parallax over this curved band. In the direct examination, correction glasses of markedly different strength were needed for focussing the floor of the ectasia from those required for the general eye-ground. On the left the condition was even more outspoken than on the right, as shown in Fig. 2.

Taking the visual field showed the blind-spot considerably enlarged, with an adjacent area, as indicated in Fig. 3, in which the perception was notably reduced. Sharply defined to the temporal side, this area of impaired perception seemed to correspond with the ectatic area to the nasal side of the papilla.

Case 3.—A clerk fifty-eight years of age, myopic and weak-sighted. The better (left) eye saw $\frac{6}{18}$ with concave 11 D; in the diverging right eye the vision was considerably lower. The opthalmoscopic examination gave as the cause of the markedly defective vision, posterior polar cataract, vitreous opacities and extensive choroiditic changes at the posterior pole. A large "annular posterior staphyloma" was bounded on the nasal side by a dark curved line, which diverged from the margin of the ring-conus above and below, being separated from it by a narrow

band of red eye-ground, as shown in Fig. 4. The vessels are markedly interrupted in their course over the dark curved line and showed distinct parallactic movement. The direct examination was difficult by reason of the opacities in lens and vitreous, but a difference of level was recognizable by the various glasses needed for focussing the eye-ground within and beyond the curvilinear boundary.

Here also there was a scleral ectasia, sharply defined to the nasal side and flattening upward and downward; to the temporal side there was a gradual rise of the distended area, with the papilla lying in the ectasia. In contrast to the two preceding cases, the nasal border of the annular conus coincided with the steeply sloping limit of the ectasia, the steepest portion of which was here also nearly in the horizontal meridian. In the visual field of the right eye a large central scotoma, nearly 40° in diameter, was found—its medial border 5°, the temporal 35°, from the fixation point[1]

CASE 4.—Prof. H. came with the left eye blind and cataractous, and the right highly near-sighted and with much reduced vision. The ophthalmoscope showed vitreous opacities, small central choroiditic changes, a large annular posterior staphyloma, which was defined at the nasal side by a dark curved line, the breadth of which varied with the altered position of the mirror. The course of the retinal vessels traversing this curved line was sharply interrupted, and the parallax was very striking in the distorted portions of the vessels.

Here again, as in the third case, we had a distension at the posterior pole, sharply bounded to the nasal side by a margin coinciding with that of the so-called "ring-conus." The distance from the papilla of this curvilinear margin was about the same in the last case as in the others.

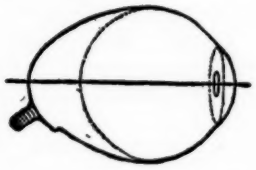
Taking the visual field showed the blind spot considerably enlarged—some 22° in the horizontal diameter—and adjacent to it a narrow zone, especially towards the fixation-point, in which the yellow square appeared "whitish" and the red "gray or grayish blue."

Not uninteresting is the statement of the patient that when admitted in his fourteenth year to the eye-clinic of S——, fear

[1] As the small ivory knob serving as the fixation point of the perimeter was not seen, the patient was directed to touch the ivory knob with his finger during the field-taking, and to look fixedly toward this finger.

was expressed that the eye might suffer from retinal detachment. It may be surmised that perhaps the ectasia already existed at the posterior pole, and that the difference of level was then noted and considered as a commencing detachment. Unfortunately, in the clinic records of the institution no detailed notes have been found bearing upon the cases.

From the foregoing, it is easy to construct a schematic sketch, as shown in the accompanying figure, of what would be presented by a horizontal section of such an eye.



These cases are of rare occurrence. Since seeing the first case in 1885, I have not neglected to search for the condition in every case of high myopia, and I do not believe that I have overlooked a single instance. Among some 20,000 patients seen in the past six years I found the condition only four times. Perhaps other investigators have observed such cases; but the communication of these seems justified, since no description of the condition, so far as I know, has been heretofore presented.[1]

Whether the sharply defined ectasia developed only in later life, or whether, if only in small degrees, it were already present in youth, is not conclusively shown by the reported cases.

As to the anatomical conditions in such eyes, I can report nothing, since no myopic eye of this character has come to my examination. The concurrence of the ophthalmoscopic appearances in the cases reported justifies the assumption that we here have to do with changes connected with some quite distinct anatomical condition at the posterior pole.

[1] The observation reported by Szili ("Zur Morphologie der Papilla Nervi optici." *Centralbl. f. Augenh.*, 1887, 1), has nothing in common with the condition described. How far the findings reported by C. Hess (*Arch. f. Ophth.*, Bd. xxxiv. and xxxvi.) have relation to our subject, remains as yet undecided.

The reported finding has nothing in common with the large or small pouchings of the sclera which one occasionally finds in pathological conditions, especially in staphylomatous, degenerated eyes, irregularly placed in the most various portions of the sclera.[1]

The ophthalmoscopic picture described, brings to my mind the finding in a macroscopic study of the near-sighted eye of a scholar, which I examined long ago. This showed in many respects a similarity, but was in others wholly different. The notes then made state: It is very striking that the sclera is very much softer at the posterior pole (medium myopia). If the eye is placed, cornea down, upon the table, the sclera at the posterior pole, sinks with the nerve in the form of an oval, of which the nerve entrance is not the centre but lies to the nasal side. This oval measures about 17 *mm* horizontally and 12½ *mm* vertically. Above and below this thinned area, the sclera is much firmer, making the boundary between the lax and the firm sclerotic a sharp one: outward and inward the boundary is less sharp. If the eye be lifted by the optic nerve, the sclera forms a fold in the horizontal meridian reaching far forward. A broad horizontal band of the sclerotic, then, in the posterior segment of the bulbus is much more yielding and lax than the remainder; and the softer portion of the sclera surrounding the nerve entrance has taken on a different coloration in the Mueller's fluid. The accompanying sketch (Fig. 5) will indicate the condition described.

[1] Occasionally one finds in the case of these diverticular pouchings of the sclera, that the retina does not clothe the distended portion, but stretches across the base of the pouch.

REMARKS ON IMMATURE CATARACT AND THE BEST METHOD OF HASTENING MATURITY.

By JOSEPH A. WHITE, A.M., M.D.,

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THE question of the maturity of cataract is an important one for those whose eyesight is failing from opacification of the lens. It is usually considered a simple matter for an expert ophthalmologist to decide when this opacification has reached the stage of "being ready for operation."

When is a cataract ripe? Probably the answer to this question is one upon which all ophthalmic surgeons agree—*viz.*, when it will leave behind no cortical substance in a condition to swell and set up secondary irritation and inflammation.

The most expert of us is at times deceived in a nice calculation of this condition, and the error is likely to be followed by trouble, sometimes by destruction of the eye, or opacity of the cornea from resulting choroiditis. Schweigger (*Deutsche med. Wochenschrift*, 1890, p. 695) thinks cataract can always be safely removed without leaving large enough remnants behind to be dangerous, as soon as the lens has lost its elasticity, when it has become flatter, and accommodation has disappeared, even if considerable portions are still clear. This occurs usually between sixty and sixty-five years of age. Under this age the clear part of the cortex forms a sticky substance, which is most likely to remain behind, swell, and cause trouble.

Undoubtedly the best safeguard against danger of failure is perfect opacification of the lens substance, and the object

of this paper is to consider which is the best, safest, and surest method of artificially obtaining this result. Apart from the fact that it lessens the risk of cataract extraction it has another aspect of prime importance—it shortens the period of cataract formation, which may extend from a few months to several years, and to a man in moderate circumstances, with a family dependent upon his labor, this might entail ruin and poverty if it be prolonged to any unreasonable extent. Consequently, all suggestions to hasten maturity have been given a trial.

Puncture of the anterior capsule, combined with iridectomy, attributed to Mooren (1858), has for years been a means employed to this, and it often failed in its purpose. Moreover, the danger of resulting iritis from swelling of the lens barred its universal adoption.

When Foerster, of Breslau, at the meeting of the Heidelberg Ophthalmic Society, in September, 1881, suggested his method (see ARCHIVES OF OPHTHALMOLOGY, vol. xi., p. 344, "On the Maturity of Cataract, its Artificial Ripening," etc.) of triturating the lens through the cornea after an iridectomy to hasten the maturity of cataract, it was recognized as a great advance in this direction. It was the outcome of his and others' observations that cataract frequently ripened more rapidly after a preliminary iridectomy. Since then his operation has been the standard one for artificially hastening opacification of the lens.

In 1883 and 1884 I performed it five times, but was dissatisfied with it, because I had unpleasant complications in two out of the five cases; in both there resulted considerable irritation, followed by iritis with posterior synechiæ in one and corneal opacity in the other.

In 1885 (*N. Y. Med. Jour.*, Dec. 26, 1885), I saw a suggestion from Dr. T. R. Pooley, of New York, that the opacification of the lens could be brought about by triturating after a simple paracentesis of the anterior chamber *without iridectomy*. He tried it successfully on rabbits. Within a few days I tried it on a negro patient who presented himself at my clinic in the Richmond Eye, Ear, and Throat Infirmary with a cataract about half ripe. In forty-

eight hours the opacification had so far advanced that no red reflex could be obtained. In three weeks the cataract was successfully extracted. This and another case were reported in a paper read before the Virginia State Medical Society ("Results of Clinical Work at the Eye, Ear, and Throat Infirmary," etc.) in 1886, and as far as I can find they were the first recorded cases of this method of ripening cataract in the human being.

Prior to my report of those cases, and before Dr. Pooley made his experiment on rabbits, Candrou in 1833 ("Maturation artificielle de la cataracte," *Rev. gèn. d'ophtal.* 1883, No. 6), in an article recording six successful cases of ripening cataract by Foerster's method, suggested that it might be done equally well without an iridectomy, but does not mention any cases thus operated on. Gunning of Amsterdam also made the same suggestion of simple puncture and massage in April, 1886, at the Paris meeting of the French Society of Ophthalmologists. As far as I know, Candrou was the first to suggest this method, Pooley the first to perform it, but on rabbits only, and mine were the first successful cases on the human being. The third case I tried gave quite a different result. The patient was an Italian with slight central opacity of the lens. With a contracted pupil, his vision was very bad; dilated with a weak solution of atropia it was fairly good. He could read ordinary type. Still, experimentally, and to test the value of the operation, I did a paracentesis and triturated the lens. A few days after I found to my astonishment the opacity of the lens smaller and thinner. When the resulting injection of the eye had disappeared, I triturated again. A few weeks later, I could find no opacity in the lens. I thought I had made a discovery, *viz.*, that, in the very incipiency of cataract with a small and faint opacity, massage would cause its disappearance. I have tried it several times since with invariable disappointment. My apparent discovery was no discovery. It was an isolated case, interesting as such, unexplainable in its result, but its clinical significance was entirely negative. A very similar case was reported by Tatham Thompson in 1890. (*The Royal London Ophthalmic Hospital Reports*,

vol. xiii., part i., p. 38). Others have thought they had found the way to aborting opacification of the lens in its incipiency, but the methods suggested have not been accepted with much favor, and the results recorded have been regarded as doubtful. The attempt to dissipate early opacities of the lens by the continuous current has been made, and some claims to success set up, but they proved fallacious.

There is no doubt that a method of aborting cataract is ardently to be desired, but it is still one of the problems of the future. Lacking this, the next best is an early and speedy ripening. Besides the old mode of division, and Foerster's method of "iridectomy and trituration," other suggestions have been made to accomplish this result.

Rohmer in 1886 ("Maturation artificielle de la cataracte," *Union Méd.*, 1886, p. 298) suggested a modification of the ordinary method of division with trituration. Two or three little openings are made in the capsule with a division needle, the aqueous is thoroughly evacuated, and the massage is made by the fingers through the upper lid.

Domingo Sasso of Buenos Ayres in 1888 ("Maduracion artificial de la catarata por el massage del cristalino sobre la cristaloidea. Nuevo procidimiento. Inaug. Thesis, 1888) presented an inaugural thesis on a new proceeding for ripening cataract, suggested by Dr. Ricaldi of Buenos Ayres, which consisted in massage of the lens directly on the capsule by means of a spatula introduced into the anterior chamber through a small opening made in the cornea, and reported five cases with brilliant results. This method Dr. Bettmann of Chicago has successfully practised. Dr. Born of New York recently told me he also had tried it, with satisfaction.

The means of ripening immature cataract are therefore:

1st. Simple division of the anterior capsule.

2d. Division combined with iridectomy.

3d. Division and external massage.

4th. Iridectomy and external massage.

5th. Paracentesis of the cornea and internal massage directly on the anterior capsule.

6th. Simple paracentesis and external massage. In considering these methods, it is advisable to choose the one least likely to cause complications provided it accomplishes the result.

The first three in which division of the anterior capsule is performed, including Rohmer's operation, are always attended by the danger of violent inflammation, and loss of the eye, to say nothing of the minor risks of iritis and corneal opacities. The most accomplished ophthalmic surgeon cannot always determine when a dangerous reaction will follow a wound of the lens, even when done with all ordinary prudence and care. The opening in the capsule may be made so small by a timid operator as to fail entirely of its purpose; or a bolder surgeon may make it so large as to result in a too rapid swelling of the lens with its hazardous consequences. Again, even a large opening may be entirely negative, the only result being an oozing out, as it were, of a plug of cortical substance, whitened by contact with the aqueous humor which closes the opening and leaves the lens *in statu quo.*

The fourth method, known as Foerster's, is the one usually done, and all who have performed it know that it is not unattended by danger of serious complications, as iritis is a not infrequent result. Noyes, Bull, Theobald, Moebius, McHardy, and others have reported iritis following their operations, and Mittendorf has even recorded the loss of an eye as a result. Moreover, the iridectomy itself is a grave traumatism and disfiguring in this day of simple extraction.

The fifth method of *internal massage*, as I have denominated it, Ricaldi's operation, I have no experience with. It necessitates, however, an opening in the cornea large enough to manipulate an instrument in the anterior chamber and the introduction of a spatula into the eye, traumatisms of sufficient gravity for consideration, besides massage directly on the surface of the lens, which requires great care to avoid a dislocation of the latter.

The sixth and last operation of "simple paracentesis and external massage" is free from all the objections urged against the other operations. There is no wound of the

capsule or iris, the traumatism of simple puncture of the cornea is very slight, and the cortical substance can be sufficiently disturbed and bruised by the massage through the cornea to mix it up, as it were, so that the clear and opaque parts mingle together, resulting in rapid opacification of the translucent portions. I think the result due to mechanical disturbance, and not to an alteration of nutrition. If artificial ripening of an immature cataract is advisable at all, we have here an operation of slight traumatism, of easy accomplishment, of minimum risk, and of rapid and brilliant results in the majority of cases. Whether artificial ripening of an advancing cataract is desirable in certain cases or not, is a question still in abeyance. Some ophthalmologists object to it, their objection being based on the more or less hazardous character of the proposed operations, and either wait for nature to ripen it, or proceed at once to extract it in its unripe condition. All ophthalmic surgeons have had to do this under certain conditions, but very few care to attempt it, unless circumstances demand it, because of the attending risks to a successful restoration of vision. Some, however, prefer to extract the unripe cataract rather than to do any operation to ripen it, and the means suggested to lessen the risks are peripheral incision of the capsule, so that the retained cortical may rest innocuous in its sac, and irrigation of the anterior chamber to wash them out of the eye through the corneal wound.

Tweedy, of England, is the strongest advocate of removing immature cataracts by the former method, his operation being upward section of the cornea, iridectomy and peripheral capsulotomy. This mode of opening the capsule was first suggested by Gayet, of Lyons, and its best known champion has been Knapp, who has for many years employed it in his cataract operations.

The question of irrigation of the anterior chamber was first discussed by Prof. Horner, of Zurich, at the International Congress of London in 1881. Wicherkiewicz, of Posen (*Klin. Monatsblätter*, Nov., 1885; and also "Sur l'irrigation des chambres de l'œil pour l'extraction de la cataracte," *Soc. française d'ophtal.*, April 30, 1886), first put it into practice,

especially in regard to immature cataracts. He flooded the anterior chamber with a solution of chloride of sodium (7–1000) boiled and cooled down to thirty degrees Cent.

McKeown (*Brit. Med. Jour.*, Oct. 29, 1888) advocates the same method for extracting unripe cataracts, using simply warm water.

Panas (*Bulletin de l'Académie de Méd. de Paris*, Jan. 1, 1886) irrigates with a solution of biniodide of mercury (1–20,000), and others of the French school follow his methods. Dr. Lippincott, of Pittsburgh, practises irrigation with a solution of boric acid, probably the only safe fluid to use, and has devised a syringe that lessens the risk (*Transac. Am. Ophth.*, Dec., 1891). As nearly all the advocates of irrigation of the anterior chamber in cataract extraction, whether of ripe or unripe cataract, claim two absolute essentials for its successful performance, *viz.*: immobility of the operated eye, and perfect control of the hand of the operator, we may safely say that it is a more or less hazardous addition to the steps of the operation, because while the skilled operator is supposed to have perfect control of his hand, no surgeon can insure immobility or quiet in the operated eye. With Dr. Lippincott's syringe these conditions are not absolutely necessary. We must not take too much for granted even in regard to the hand, for I have seen a shaky hand more than once in accomplished and presumably dexterous ophthalmic surgeons. Hence I conclude that if time is to be saved by early operation for cataract, and if we must decide between removing it in the unripe state, or attempting to hasten its maturity, we should first try to ripen it, unless we can guarantee both hand and patient. This remark carries greater force in view of the success that in my hands has attended the operation I here present, and its comparative freedom from surgical risks. The only objections that can be made to it are that the zonula might be slightly detached by too great violence, and the risk of loss of vitreous in the subsequent extraction increased. I have performed fifteen of these operations in all, and in not one single case was there iritis, corneal opacity, dislocation of

the lens, or trouble in the subsequent extractions, which were perfectly smooth, and resulted in good vision.

Every case of cataract does not need help from the surgeon to hasten its maturity. It is only a small number of the grand total that require it. When cataract has advanced in both eyes equally, and when the patient has reached the stage of no longer being able to read or attend to the work that gives him and his family support, this necessity arises. Even in these cases, some are not suitable for massage, for *unless the zonula is intact and the pupil can be dilated*, this operation should not be attempted. It is most successful when the nucleus has become opaque, as it acts as a base upon which to crush the cortex.

Opacities at the posterior pole, if large enough, serve the same purpose. But I have operated equally on true cortical cataracts as soon as the opaque peripheral striæ had invaded the pupillary area sufficiently to interfere with reading.

The operation is especially called for under sixty years of age, when the cataract has reached the proper stage, because the cortex is then more liable to be sticky and give trouble. I think it would be a prudent precaution to triturate all cataracts under that age (unless hypermature), even when apparently ripe, so as to dislodge the sticky masses of cortex from the capsule and perfect their opacification, thus insuring their easier delivery.

My method of operating is very simple. After satisfying myself that the tension is not below normal, that the zonula is intact, and that the pupil can be easily dilated, I thoroughly evacuate the aqueous humor with the ordinary paracentesis needle, and vigorously rub the lens through the cornea, up and down, out and in, as well as in a circle, varying the direction of the rubber or tortoise-shell spoon I employ to avoid striated opacities of the cornea, which may result from constant friction in one direction. I usually continue this until the irritation of the eye warns me to desist. Atropia is instilled immediately, and cold applied to the eye, the patient holding a piece of ice, rolled in a thin layer of absorbent cotton, against the closed lids until the eye aches; after the aching subsides, it is reapplied. An

hour or so of this treatment, followed by instillation of atropia every hour or two the same day, is all that is done. No bandage is used. Sometimes considerable irritation is manifested, and slight pain is occasionally complained of, but I have never seen any unpleasant complication. In the majority of my cases the lens showed increased cloudiness the next day, and I have seen cases that could make out large letters become perfectly blind in forty-eight hours. In some the opacification proceeds more slowly, taking several weeks to become complete. Even where it is seemingly very rapid, I think it advisable to wait two weeks for the extraction. In two of these cases I had to repeat the operation four weeks after the first trituration because of the tardy result. In one of them opacification was complete forty-eight hours after the second attempt at ripening the cataract.

The last two cases of cataract ripened by this method will serve as illustrations of the operation and its results.

Case 1 (Nuclear Cataract).—W. B. Goodwin, of Hampton, Va., æt. forty-two, consulted me on Sunday, March 27, 1892. He had cataract developing in both eyes. In the right eye it was in its incipient stage, and vision was $\frac{20}{40}$. The left eye had an opaque nucleus and clear cortex free from striæ. Vision with a dilated pupil was $\frac{10}{200}$. He told me the left eye began to fail about seven or eight years before, and had very gradually reached its present condition. He had gone to Philadelphia twice, the last time about Christmas, 1891, and had each time been sent back to wait for a more complete opacification of the lens before it could be extracted. He had come to me to see if something could not be done to hasten matters and end this interminable waiting. I suggested that he allow me to ripen it. He consented. I dilated the pupil thoroughly, evacuated the aqueous humor, and triturated through the cornea with a tortoise-shell spoon for about two minutes. The eyeball became somewhat injected. I prescribed a solution of atropia, cocaine, and boracic acid, ordering it to be used every two or three hours. He left my office to see the city, and returned to Hampton on the afternoon train. Two weeks after, he came back again on Sunday. I found the lens perfectly opaque throughout. He said he had had some slight pain and irritation about the eye the evening following the operation, and

that it was perfectly blind in two days. On the day after his return I extracted the cataract with a simple corneal section, and removal of the anterior capsule with Eugene Smith's modification of Knapp's capsule forceps. The operation was smooth and the healing rapid. On the tenth day he returned to Hampton. On May 29th he came again to have the capsule needled and get his glasses. His condition was as follows:

Cornea, clear; iris, normal in appearance; pupil, round and perfectly black, without a sign of cortical remnants, and freely responsive to the stimulus of light. When I dilated it with atropia to examine the capsule, some remains of cortical substance could be seen in the periphery of the capsule, but the centre was clean and clear. His vision was $\frac{20}{20}$ easy, with + 11 D ⌒ + 2.5 D_c ax. 15°.

Probably this astigmatism will decrease slightly in the next few months.

CASE 2 (Cortical Cataract).—P. Whitlock, manufacturer of the world-famed Virginia Cheroots, age 56, had the left eye triturated by this method March 26, 1892. The opacities in the lens were mostly in the cortex, especially in the periphery, though there was a slight central cloud. The reflex was good, the retinal vessels could be made out, and vision was $\frac{20}{200}$. In twenty-four hours I could get no illumination of the fundus, the opacification was generally diffused, and he could not count fingers. Although he had the cataract ripened for an early extraction, his business has kept him so occupied I have not yet operated on him. He was in no hurry, because he had good vision ($\frac{20}{40}$) in the right eye, from which I had removed a cataract September 16, 1891. This eye was one of the two I referred to above where the trituration had to be repeated. On April 23, 189$\bar{1}$, I attempted to ripen the cataract, but probably from insufficient massage it progressed so slowly that on June 16th I repeated the operation with resulting complete opacification in forty-eight hours. As the weather was so hot I advised him to wait until the fall for the extraction, which I successfully performed in September as above mentioned. In this case there was slight prolapse of the iris caused by his restlessness, and this retarded the healing, otherwise everything went well. In both cases the delivery was easy and clean, the cortical masses coming away without trouble.

I also present two other cases operated on by Dr. John Dunn, chief of clinic at the Richmond Eye, Ear, and Throat

Infirmary, and which he has reported in his own words, as follows:

CASE 1, *August*, 1891.—Mrs. W., aged sixty-three, says her sight began to fail her several months ago, can now no longer read with any glass. Can distinguish outlines of objects, but can see nothing distinctly. Both lenses show numerous opaque plates, without any general clouding. Lens substance between the plates transparent. Fundus visible, but no details can be made out. Patient declines to have cataract ripened.

November 28, 1891.—Patient returns, lenses in same condition as in July. "White's operation" done on O D. *December 5th:* small cloudy areas have appeared throughout the transparent parts of lens, although not sufficient to ripen the entire lens.

January, 1892.—Both lenses extracted without iridectomy, that of O S without previous ripening, and considerable transparent lens substance proves to have been left behind. In O D vision equal ($\frac{1}{2}\frac{8}{0}$) after discission.

Following discission in O S there was iritis with adhesions to the capsule and secondary glaucoma, necessitating an iridectomy.

CASE 2, *February*, 1892.—Mr. L., aged 78 years, sight of O D has been failing him for months. O S has been useless for years owing to a dense corneal scar. Patient can make out indistinctly objects held in front of him. $V = \frac{1}{2}\frac{0}{0}$. Slight general clouding of the lens.

February 6th.—"White's operation" done in O D.

February 10th.—But little change in the condition of the lens; probably trituration was not thorough enough.

February 14th.—"White's operation" repeated.

February 21st.—Entire lens opaque and ready for extraction.

This patient did not return for operation until May, when the lens was successfully extracted, the result being all that could be desired.

You will observe in these cases, both over sixty years of age, one sixty-three and the other sixty-eight, that the operation was of considerable service. In the first case in which trituration was done on one eye and not on the other, although both extractions were done by the same method and with equal skill, in the triturated eye the cortical substance was easily evacuated, and there was little or no

subsequent trouble; whereas, in the eye on which trituration was not done, the transparent lens substance was left behind unknowingly, and there has been annoying and dangerous complications, such as iritis, adhesions between capsule and iris, and secondary glaucoma. In the second case, as in two of mine, the operation had to be repeated, probably from insufficient massage, although Dr. Dunn repeated the operation in eight days, a little earlier than I have been in the habit of doing it. The second operation was followed by rapid and perfect opacification of the lens.

This contribution from another operator than myself to the subject of ripening cataract by this method, which Dunn calls "White's operation," although I claim no originality whatever, except in resurrecting and putting into practice the buried suggestions of others, shows that equally good results followed in another's hands. Whilst the number of cases is not very large, they help to prove that it is practically free from surgical risks, and assists materially, as I have already claimed, in shortening the period of waiting for ripening, and lessening the risks of the subsequent extraction, thus improving the chances of success in restoring vision.

A CASE OF SARCOMA OF THE CHOROID AND CILIARY BODY.

Clinical History, by DAVID WEBSTER, M.D.

Microscopical Examination, by WARD A. HOLDEN, M.D.

(*With a figure in the text.*)

CLINICAL HISTORY.

Selah N. J., aged sixty-three, married, clerk, was referred to me by Dr. A. F. Hoag, with a letter, on February 2, 1891. Mr. J. visited my office on February 4th and 5th, being examined at his first visit by my associate, Dr. S. M. Payne, and at his second visit by me. We found a *black* tumor filling the nasal third of his right anterior chamber, and a *white* tumor projecting into the vitreous immediately behind the iris, and apparently springing from the ciliary body (see figure). A portion of the sclera, varying in width from half a line to two lines, adjacent to the nasal periphery of the cornea, and extending around about one fourth its circumference, was *stained black*. The vision was $\frac{20}{200}$ and not improved by glasses.

The patient stated that he had never noticed any trouble with either eye, except that they both would get red when he caught cold, until the 12th of September, 1890, when, while mixing mortar, he got a small portion of lime into his right eye. This caused a severe inflammation from which he recovered without the aid of a physician. From the time of the lime-burn he noticed that the sight of that eye was blurred. In the early part of January, 1891, he noticed the black spot on his eye, and then consulted Dr. Hoag, who treated the eye with atropine, sulphate of zinc, and bichloride washes, but with no benefit. He then advised him to see an oculist, and finally sent him to me.

There is no history of blindness, or of cancer, in Mr. J.'s family. His general health is good. He could see some with the eye until

some time in the fall of 1891, when he gradually lost all but perception of light. Enucleation was advised by Dr. Payne on February 4th, and the advice was concurred in by me when I saw him on the 5th. But for some reason the patient deferred the operation until April 12, 1892, when I saw him again. He had suffered a good deal of pain in and around the eye through February and March, but the pain had nearly all left him when he came to me for the operation. I found perception of light, but very imperfect projection. The tension was slightly increased; a mature cataract covered the posterior portion of the growth. The black anterior portion may have increased a little in size and area, but appeared practically the same.

Assisted by Dr. Achilles E. Davis, and Dr. Mary E. Hennessy, I enucleated the eye and placed it in Müller's fluid.

MICROSCOPIC EXAMINATION.

The eyeball after being hardened and divided by a horizontal section presented the appearance shown in the figure.

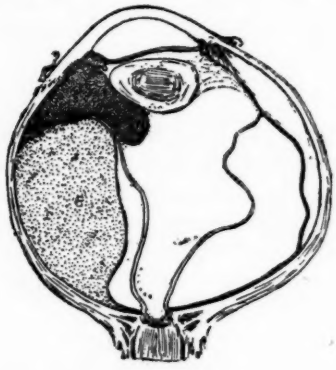
Histologically the new growth is a small-celled sarcoma, spindle cells largely predominating. The points of particular interest which it offers are the fact of there being two tumors, the irregularity in the pigmentation of the neoplasm, and the manner of its extension.

The tumor consists of two masses on a common base, one springing from the choroid and one from the ciliary body. The choroidal portion is covered with a capsule consisting of retinal pigment epithelium (the inner layers of the retina being detached), lamina vitrea, and choriocapillaris, and this capsule together with the degenerated pars ciliaris retinæ extends forward over the choroidal portion, nearly to the sclera, separating it from the ciliary portion, which latter has no capsule of any sort but projects uncovered into the vitreous chamber.

Multiple sarcomatous tumors of the uveal tract are rare. I have seen one case only in which two elevated nodules were almost contiguous and the choroid between them was infiltrated with sarcoma cells. In these cases one tumor is always larger than the other, and one may be assumed to be simply an extension of the other.

The ciliary portion of the growth is darkly and diffusely pigmented, the choroidal portion is but slightly mottled. For the purpose of studying the pigmented portion, specimens were bleached in the manner recently described by Treacher Collins.[1]

By this process I have found that the pigment in the posterior portion of the normal eye is readily removed, that from the iris and ciliary body somewhat less readily, and the pigment in the anterior portion of embryonic eyes scarcely at all. The pigment in sarcomata, however, is given up completely in a few minutes, and the cellular structure may



then be studied in an unpigmented sarcoma. In preparations from this tumor as well as from others in which the pigmentation was not uniform, the shape, size, and arrangement of the cells were the same throughout, and in the bleached preparations it was impossible to say which portions had been pigmented and which had not.

The central portion of a sarcoma may be absolutely free from pigment, the capillary walls may show spindle-shaped

[1] This valuable method is as follows. Sections cut from specimens imbedded in celloidin are put for three minutes into water with which chloride of lime has been mixed and which has then been filtered; next into water with hydrochloric acid ♏i–℥i; then transferred from one fluid to the other until bleached; next placed in water with liq. ammonia ♏i–℥iv; finally washed three times in distilled water and stained with logwood. *Trans. Ophthal. Soc.*, vol. xi.

pigmented cells, the vessels may have groups of round or spindle-shaped pigmented cells about them, single tracts of cells may be pigmented, or every cell in the tumor may be black. Yet the degree of pigmentation seems to stand in no relation to the histological structure, and in no very marked relation to the point of origin or to the malignity of the growth. The disposition of the autochthogenous pigment in the sarcoma seems to be entirely fortuitous, and such being the case the ordinary classification of sarcomata into melano- and leuco-sarcoma has no pathological significance.

As to the mode of extension. The tumor involving the entire extent of the ciliary body, on the nasal side, with the exception of the anterior portion of some of the ciliary processes, has penetrated into the head of the ciliary body, and pushed forward into the anterior chamber. The iris proper is but slightly involved but is displaced inward and forward. The entire ligamentum pectinatum on the contrary is infiltrated with pigmented cells, and from this part the same cells pass a short distance into the cornea between the lamellæ, and farther along the endothelium on its posterior surface. Even at the opposite side of the cornea the region of the canal of Schlemm is infiltrated and the angle of the anterior chamber filled with pigmented cells, showing that the process has extended in the loose tissue of the ligamentum pectinatum and the head of the ciliary body throughout the entire circumference of the cornea. In another case of sarcoma of the ciliary body of about equal development, the anterior portion of the ciliary processes is free, the head of the ciliary body and the ligamentum pectinatum have been involved and the iris displaced inward, and here also pigmented cells are found about the canal of Schlemm in its entire extent, so that this may be taken to represent a usual manner of extension. In the case under consideration the veins which pass from the canal of Schlemm through the sclera are bordered with sarcoma cells, and some small foci are found on the outer surface of the sclera.

The lens capsule is intact, but the form of the lens has

been changed by the pressure of the tumor. On the opposite side, the ciliary body has a few pigmented sarcoma cells scattered over its surface, and these continue along the hyaloid membrane and the fibres of the zone of Zinn to the lens capsule. These are not the round pigmented cells found free in the vitreous in some cases of sarcoma, but spindle cells which have developed continuously over the hyaloid membrane and the suspensory ligament, and in most instances form a layer on each surface. I have not found this extension of sarcoma cells in cases where there has been no plastic cyclitis.

The extension of a sarcoma is always in the directions of least resistance. In passing out of the eye the paths are along the sheaths of the ciliary vessels and nerves, the vortex veins, and the optic nerve. These extensions may be so small as to be scarcely recognized with the naked eye, so that even a minute pigmented point on the surface of the enucleated ball near the sclero-corneal junction, the vortex veins, or in the region of the optic nerve, should warn the surgeon of the possibility of the local recurrence of the disease.

A CASE OF HOMONYMOUS SUPERIOR HEMIANOPSIA.[1]

By Dr. F. BOÉ, of Paris.

Mr. X., forty-three years old, came to consult me in the month of October, 1890, complaining that for a long time he had not been able to see above the level of his eyes. When he stands in front of a person he discerns clearly the whole lower part of the body and the chin and lips, but the nose, the rest of the face, and head are completely invisible to him. To be able to see them, he is obliged to raise his eyes. What he perceives, however, is clearly seen. The acuteness of sight in the right eye is = 1 ; the eye is E ; the acuteness in the left one = $\frac{1}{4}$; the eye is H, 1.90. When examined with the perimeter, the superior part of the visual field in both eyes is wanting, and the limiting line comes near the point of fixation. Beyond this point it inclines slightly downward on both sides in each eye, but principally the right one, and on the same side[2] it shows in the third part of its course, nearest the fixing point, a slight depression, caused by the scotoma, which encroaches upon the preserved part of the visual field. It is not a mathematical line ; it is rather an intermediate and very narrow zone in which the sight is simply diminished. On the other side, towards the periphery, the two inferior halves of the visual field are in no way affected. The chromatic sense is well preserved, and the patient distinguishes perfectly the lightest shades of color.

Direct examination shows that the mobility of the ocular globes is perfect ; tension, normal ; the pupils react to light and accommodation. At the ophthalmoscopic examination no retinal

[1] This case has been related briefly at the meeting of the Association française pour l'Avancement des Sciences, September, 1891, and the patient was presented, October 29, 1891, at the Société de Médecine Pratique de Paris.

[2] The left side of the patient.

detachment; physiological excavation of both papillæ; vessels have their normal diameter in their entire course.

The patient has a marked diminution of smell; neither taste nor hearing are impaired; cutaneous sensibility is everywhere normal; no hysterical trouble. The knee-jerk is well marked on the right side; it seems weaker on the left. At the beginning of last year the patient had felt, for two months, a dull, persistent ache, with lancinating pains at night in his right leg, the real nature of which is to-day not easy to determine. No trouble in the gait. Three or four years ago Mr. X. felt on the street a giddiness in his head, which lasted but a few minutes, and has not since returned. Nothing in the heart nor in the urine.

The most important point to be mentioned is that six years ago the state of the visual field and acuteness of both eyes was exactly the same as to-day. At that period the disease had declared itself. It seems to have increased rapidly without any assignable cause. The patient consulted several of my Parisian colleagues, who took notes of the state of the field and acuteness of vision, and since that time nothing has changed.

I myself, since the month of October, have prescribed different remedies, and after several examinations I have always arrived at the same result. The right eye is E; V is always normal; the left eye is H, with $+ 1.90$; V is always $= \frac{3}{4}$.

As to his antecedents, it is to be observed that, except syphilis in the year 1879, the patient had never any serious disease. The father and mother died very old. No nervous disease in the family.

One would hardly find, I think, in literature many cases like the one I have just reported.

In the year 1869, Graefe said that occasionally one might see symmetrical contraction of the visual field above or below without any ophthalmoscopic signs, with a line of demarcation well traced, and preservation of the central acuteness. The observations which have been published since that time under the rubric hemianopsia superior are far from meeting these conditions, and even the related cases are also far from similar.

The cases of MM. Russell[1] and Knapp[2] do not fulfil the

[1] Russell, *Medical Times and Gazette*, No. 67, 1873.

[2] Knapp, "Hemiopic and Sector-like Defects in the Field of Vision and their Connection with Diseases of the Heart and Brain," *Archives of Scient. and Practice Med.*, No. 4, New York, 1873.

conditions mentioned. In the first, that of Russell, there was simply loss of the upper half of the visual field in the right eye, with paralysis of muscles. His right eye was first attacked by blindness, and then the left. The patient died, and at the autopsy a tumor was discovered in the bone at the base of the skull. In both of Knapp's cases there was certainly double hemianopsia downward, but with the ophthalmoscope in one case atrophy and in the other an inflammation of the optic nerves was found.

The case of Mauthner[1] met the required conditions: double hemianopsia above; no alterations in the fundus oculi; preservation of the central acuteness. In some points, however, this case is unlike mine. To be certain of this, one should not accept simple reports, but consult the original text of the observation.

A young man about twenty-two years, after having suffered violent pains in his head, swoons. Three days later he is up again. He complained of not seeing in the superior part of the visual field, particularly above and to the right side. His memory is weak; he has headaches frequently; he is often out of temper.

Two years after, the acuteness is still normal. Both the inferior parts of the visual field are preserved; they are separated from the blind parts by a curved line, which passes above the point of fixation. In the right eye, lower on the external side, it reaches the horizontal meridian. Six months after, there was an epileptic fit. These attacks returned every month for two years, and were consecutive during the third year. They then came back only at intervals of three or four months; then again monthly.

Three years and a half after the first perimetrical examination, it is remarked that the visual acuteness is the same, and this time the defects in the visual field are found re-established. The patient lived for two years longer, and one day about seven years after the superior hemianopsia had declared itself, he was found dead in his bed. The

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[1] Mauthner, *Vorträge aus d. Augenheilkunde*, fasc. vi.–vii. (Gehirn und Auge. S. Hemianopsia).

autopsy, which did not take place under Mauthner's direction, remained without result.

My patient, in the beginning of his disease, never swooned; he never complains now of headache. The limiting line of his visual field of the right eye, as well as of the left, borders upon the point of fixation. The condition has not changed in six years. He never had an epileptic attack. Three years ago he felt a slight giddiness, which lasted but a few minutes.

Both cases of superior hemianopsia mentioned by Schweigger[1] are too briefly described to allow of a comparative study.

In the first case it is said only that by the perimetric examination of both eyes of a patient in the Charité Hospital of Berlin the visual field was found wanting in the superior part. The visual acuteness was almost normal. No ophthalmoscopic alteration. Later, on a new examination, it was found that to some extent there was not really an absolute loss of sight, but amblyopia merely.

The second case was a patient who was treated in February, 1876, for a visual trouble which began in December, 1876, in the left eye, the cause of which was attributed to hemorrhages of the retina near the macula lutea. The acuteness of the right eye has been impaired for three years in consequence of choroidal alterations, also near the macula lutea. At the same time Schweigger repeatedly found a loss of the visual field above, which the ophthalmoscopic alteration was not sufficient to explain.

Easy as it may appear, considering the anatomical and physiological facts, to attribute lateral homonymous hemianopsia to well-defined alterations, just so difficult is it to find the cause of a hemianopsia above or below. Several suppositions have been advanced.

Mauthner supposes that the nerve fibres, which are distributed in the inferior part of the two retinas, are found in the inferior part of the optic nerves, commissure, and tracts. If they are compressed from below upward, superior

[1] Schweigger, "Hemiopia und Schnervenleiden. Eine klinische Studie," *v. Graefe's Archiv*, Bd. xxii., pp. 276–323.

hemianopsia may result. Compression of the superior part of the optic nerves, tracts, and commissure would cause homonymous inferior hemianopsia; however, he says, if really in such hemianopsia the limiting line passed just through the fixed point (which it did not in this case), it would be absolutely impossible to explain the fact by the existence of compression at the base of the skull, because it would be difficult to admit that a tumor compressed the optic nerves from below upward or *vice versa*, so that the fibres which lead to the superior or inferior half would be fully compressed, while all the others remained intact. I have noted in my observation that for six years the limiting line borders upon the point of fixation and that the visual acuteness remains the same.

Schweigger does not admit that the superior hemianopsia was owing to a retinal hemorrhage, in the case of his second patient; he cannot attribute it either, considering the excellent general condition of the man, to a disease of the base of the skull. It is better to suppose, he goes on to say, that the cause of such condition is a disease of the two optic nerves, even when we cannot explain this fact by the existence of a manifest alteration in the fundus.

In support of his hypothesis, he quotes the symmetry with which in any disease of the optic nerves, such as progressive atrophy, alterations with progressive contraction of the visual field, and central scotoma, affect both eyes. I must ask: are such cases, especially the two first, which lead certainly to blindness, to be compared with my patient, in whom in a very short space of time half of the visual field was wanting, and then the disease remained stationary? How would alterations of both optic nerves be intelligent enough to progress with the same rapidity and to stop in the same moment?

It is said also that a superior homonymous hemianopsia could be produced by double symmetrical alterations of both occipital lobes. This may be admitted, but the clinician will accept this theory with diffidence.

There is another hypothesis which I have nowhere heard expressed and which would explain wonderfully well the

fact which I have already stated. If at first I hesitate to advance this, it is because, with my patient, a sensible diminution of smell was noticed at the same time that the superior hemianopsia was observed. The simultaneous appearance of both symptoms does not seem doubtful, and every one knows that the loss of smell is one of the principal signs of a disease of the base of the skull, one which should, especially at first, fix the attention in cases of heteronymous hemianopsia. But it is known that a false hemianopsia has very often an irregular evolution, and can as well recover as produce blindness of the one eye or both. Such hemianopsia is accompanied with other disorders and specially with paralysis of the third and fourth nerves. With my patient, the smell only is impaired. It might happen, indeed, that the specific disease which had attacked my patient, and which by its proteiform nature could cause so many various localizations and clinical peculiarities, had led to alterations producing here loss of smell and there homonymous superior hemianopsia.

One does not attribute to the loss of smell a particular significance.

My hypothesis is as follows: It is known that the optic tract of the right side furnishes a bundle going to the temporal part of the retina of the right eye and a crossed bundle going to the nasal part of the retina of the left eye; thus the optic tract of the left side gives a direct bundle to the temporal part of the left eye and a crossed bundle to the nasal part of the right eye; besides this, each tract is bound to the occipital lobe of the same side, and each occipital lobe is bound consequently to the two retinæ. In the binocular field, it is the left occipital lobe which looks to the right; it is the right occipital lobe which looks to the left. At present, admitting that by a simple anomaly of distribution one tract might send its crossed bundle and also its direct bundle to the superior halves of the two retinæ, and the other tract to the inferior halves, then one of the occipital lobes will look downward and the other will look upward. An alteration of the first lobe will cause superior hemianopsia; an alteration of the second lobe will cause

inferior hemianopsia. A superior or inferior hemianopsia might present, then, all the symptoms of the real hemianopsia; the homonymous, right or left hemianopsia. Such hemianopsias develop rapidly, to remain stationary. The visual acuteness is little or not affected at first; it does not grow worse afterwards; the limiting line of the visual field passes through the point of fixation; it is well known, however, that even in such cases one half may encroach slightly upon the other. Frequently there is no sharp demarcation between the blind and the seeing halves; there is a narrow zone in which the sight is only impaired. The ophthalmoscopic examination is negative. But I have observed all these facts in my patient, and I cannot insist too much upon the fact that he possessed them already six years ago. This case gave me the idea that I had before me a classical homonymous hemianopsia simply reversed, which was caused by an alteration of a single occipital lobe, the cause of which was a specifical disease. Certainly the hypothesis of an abnormal distribution of the nerve fibres to the two retinæ would explain the fact, which I have related, better than a compression of the optic nerves, commissure, or tracts, better than a double symmetrical disease of the optic nerves, or still a double and symmetrical change in both occipital lobes. It is for this reason that I felt myself authorized in presenting it.

FIVE CASES OF KERATO-CONUS TREATED WITH GALVANO-CAUTERY.

By H. KNAPP.

(*With a drawing.*)

IT is not my intention to discuss the different methods of treating kerato-conus, but simply to make public the manner and results of galvano-cautery with which I have operated on six eyes during the last three years.

CASE 1.—*Advanced hereditary kerato-conus in both eyes. Galvano-cautery with perforation of the corneæ. Slow healing in the one; formation of cataract, cured by discission, in the other. Result good in both.*

Patient, a healthy young man, seventeen years of age, of Syracuse, N. Y., came to me July 8, 1889. His mother had kerato-conus in both eyes. The left had been operated on by the late Dr. C. R. Agnew, with paracentesis and excision of a piece of cornea. The healing had been very slow, owing to constant relapses of keratitis. The result was unsatisfactory. The son's disease began in his fourteenth year and was steadily progressing. When I saw him there was a marked conicity of both corneæ, the somewhat opaque apex being a little below the centre of the cornea. Fundi normal. He read Sn 1 no farther than 1″ before each eye. With his glasses R $\frac{2}{200}$, L $\frac{1-2}{200}$. Shading his eye he read R with $-\frac{1}{8}\frac{20}{200}$, L $-\frac{1}{8}\frac{20}{200}$.

The LEFT EYE was operated on at the N. Y. Ophthalmic and Aural Institute, Oct. 3, 1889. The eye, as all the others, was cocainized. A fine loop, brought to a red heat, was passed over the apex of the cone in an area of 2 × 3 *mm.* Then the centre

was pierced. Aqueous spurted forth in a jet. Patient remained in the hospital six weeks.

There never was an intense inflammation, but the wound closed and opened about seven times, the anterior chamber being restored 3-5 days, then empty 2-5 days. Some anterior synechiæ formed several times, but always ruptured again under atropia. In the fifth week the wound closed permanently, with a dense, sharply circumscribed scar below the centre of the pupil, free from synechiæ. Only weak glasses were accepted. There was still a good deal of ophthalmoscopic metamorphopsia. During six months the cornea flattened more and more. Then he read Sn 1 at a distance of 10″ fluently, and $\frac{2}{4}\frac{0}{0}$ — with — $\frac{1}{5}$. In eighteen months his distance glass was — $\frac{1}{10}$; S $\frac{2}{4}\frac{0}{0}$. He had one attack of a transient and mild keratitis eight weeks after the operation, in which the cornea was hazy and somewhat more bulging. Under pilocarpin and compressive bandage the attack soon disappeared without doing any damage.

Right eye. On account of the protracted healing of the left eye, I made only a very small perforation in the right. On Oct. 19, 1889, I cauterized the apex of the right conus in the same manner as I had done in the left, only I applied the point of the electrode repeatedly to the centre of the wound, until I saw the aqueous just ooze out. This more cautious but also more prolonged operation was followed by a severe and protracted reaction: pain in the eye, swelling of the edges of the upper lid, slight chemosis, anterior synechia, swollen and discolored iris, spongy exudation in the anterior chamber, which, when absorbed, left a peculiar yellowish opacity in the lower part of the pupil and behind the iris, opposite the scar from the cauterization.

A hypopyon, 1-2 *mm* in height, was present for three weeks. It had disappeared Dec. 3d. The other irritative symptoms gradually vanished, and the patient was discharged with a white sclera, normally curved cornea, having a sharply defined scar below the pupil. The eyeball, which at times had been soft, had resumed normal tension, and had good perception of light in every direction. The yellowish opacity in the pupil had been replaced by a grayish-white flat cataract, which I needled, Apr. 8, 1891. No reaction. Discharge in ten days. Secondary discission of the capsule, April 30, 1891. Discharge in a week with S $\frac{2}{4}\frac{0}{0}$ +, by + $\frac{1}{3\frac{1}{2}}$ + $\frac{1}{10}$ c. 75.

Aug. 26, 1891, the patient's sight was R $+ \frac{1}{3} \frac{20}{20}$, L $- \frac{1}{10} \frac{20}{40} -$. In the autumn he passed his examination for Yale College and has pursued his studies there without any discomfort.

Remarks. I asked myself whether the protracted inflammation, irido-cyclitis, of the right eye, the unusual yellowish exudation opposite the scar, and the subsequent cataract had not been the effect of the heat transmitted from the red-hot electrode to the aqueous humor, iris, and lens. I have read, here and there, some words of warning, in this respect, but can say that I have employed galvano-cautery most extensively for years, and in some cases, for instance in sarcoma of the sclero-cornea, a great deal more intensely than in the above instance, without the slightest reaction. Yet in order to better judge of the effect of heat on the crystalline lens, I made a number of

EXPERIMENTS ON RABBITS.

First eye. Simple perforation in centre of cornea with galvano-cautery. Healing without reaction, leaving a well circumscribed, very small scar (1.5 *mm* in diameter).

Second eye. A strip of 8 × 5 *mm, deeply burned without perforation.* The strip filled up without reaction, leaving a superficial scar of very little intensity.

In burning, with a flat electrode, human corneæ from which I had removed pseudoplasms, I noticed that superficial cauterization left no scar, deep cauterization a thin scar. I found the reaction and cicatrization of these cauterizations surprisingly insignificant.

Third and fourth eyes. Central cauterization with cautious perforation. Healing without reaction. Wound closed in a few days, filling with gray tissue from periphery, leaving a well defined, circumscribed scar.

Fifth eye. Extensive burning, + 5 *mm* in diameter (*until aqueous escaped*). Wound open a week, iris applied to it. In three weeks a large, but well circumscribed scar. No anterior adhesion. Eye, apart from scar, healthy.

Sixth eye. Piercing cornea and lens capsule with galvano-cautery. Wound closed in a few days. Repair without inflammation.

Seventh eye. More extensive burning with piercing of cornea and lens capsule. Marked reaction. In a week the cornea was milky, in upper part vascular. The cauterized spot depressed, white in centre, a band of mucoid tissue, 10 *mm* long, hanging out of it. On fourteenth day cornea sloughing, eye suppurating.

Eighth eye. A round area, of 5 *mm* in diameter, was singed long in order to see whether heat produced cataract. No perforation. In a few days the wound was found clean, the anterior chamber shallow. Then intense iritis and partial suppuration of the cornea set in. On the fourteenth day, when the rabbit was killed, the eye was improving, but severely damaged.

These experiments showed that the reaction and the subsequent scar are proportionate to the extent of the cauterization. Moderate burnings, without or with perforation, healed kindly and left circumscribed scars. Extensive and prolonged cauterizations led to intense iritis, suppuration and sloughing of the cornea. These experiments, which give, so to speak, only a qualitative analysis of the problem, might be continued, determining with more precision and on a large scale the quantitative effect of galvano-cautery, with measurement of the size of the electrode, the influence of red and white heat and of the duration of the application, the depth and extent of the cauterization, and the effect of the perforation. Such experiments might give valuable practical results, not only for the treatment of kerato-conus, which is a comparatively rare disease, but for serpent ulcer, corneal pustule, hypopyon keratitis, and infected wounds.

Case 2.—Miss A. Sch., æt. thirty-two, of Denver, Col., presented herself May 1, 1891. Had had an ulcer in left cornea four years previously. Sight steadily worse ever since. Now marked kerato-conus in the left eye, slight in the right. The apex of the cone in the left eye was a little out and down from the centre of the cornea, and irregularly opaque. Ophthalmoscopic metamorphopsia and all other symptoms marked. Reads Sn 6 at 1″. R with $-$ 18^{c} 80^{a} $\frac{20}{30}$ $-$.

Operation, May 8, 1891. Desirous to obviate prolonged and irregular cauterization, I had an electrode with an oval end plate,

3 × 2 *mm* made by E. B. Meyrowitz (see figure), which I applied cold to the apex of the kerato-conus, and withdrew it as soon as it had been brought to a red heat. Then I pierced the centre of

the eschar with a fine-pointed electrode. The operation was followed by no reaction, the wound closed in eight days, broke two days later by disturbance of the bandage, and closed definitely a day after.

The cornea flattened more and more. No synechia. When she left New York, eleven weeks after the operation, the corneal scar was still prominent, only there was but little ophthalmoscopic metamorphopsia. She read, by undilated pupil, Sn 2 at 3″, and with $-4\frac{4}{8}$. Later I heard from her oculist in Denver that she continued doing well. The other eye has remained *in statu quo*.

Case 3.—Mrs. Dr. W., æt. forty-six, New York, came in May, 1882, with a conical prominence of the R cornea, read 0.3 (J. 1) at 3″, with $-\frac{1}{4}\frac{20}{100}$. L eye normal. In May, 1884, the right eye had become worse and the left showed a slight prominence. with its S $-\frac{1}{18}^{c}$ 45^{n} $\frac{8}{10}$. May 16, 1891, the left eye still had only a slight kerato-conus, but the right was so conical, and the apex in and below the centre so opaque that the vision was virtually abolished.

The operation on July 18, 1891, was performed as in the previous case, *viz.*, cauterization with the slightly convex, oval electrode, then piercing of centre of eschar with pointed electrode. No reaction. Anterior chamber restored in eleven days. During the next four weeks repeated attacks of increased eyeball tension relieved by pilocarpin. Extensive adhesion developed between the lower border of iris and the corneal scar. The scar became scarlet red (teleangiectatic adherent leucoma). The lateral and upper borders of the pupil were tied down to the lens by brown adhesions. Cornea slightly hazy, sight comparatively good, field of vision complete. *Aug. 30th.* Intense pain, nausea, + T1, not influenced by eserin and cocain. A hypodermic injection of morphia at the temple brought relief and sleep, and diminished the tension.

Sept. 1st I made a downward iridectomy, cutting with a lance-shaped knife from the lower corneal border clear through the

adherent iris, which I detached completely from the cornea. The prolapsed iris was seized and exsected. The operation was followed by no reaction and had the desired effect. The eyeball tension became normal, the pain disappeared at once, the iritis soon, and the red cap of the eschar was converted into a leucoma, the redness having diminished from the centre to the periphery. The cornea cleared up. The patient was discharged Sept. 8, 1891, having been in the hospital fifty-one days. She came to my office six weeks later. There was no irritation, the cornea had flattened, but the sight was only moderate. On my request she came again Sept. 16, 1892. She had had no discomfort from that eye. Central well defined macula corneæ. Natural pupil above and artificial below clear, no synechiæ. No metamorphopsia. Reads No. 1 at 4″; with $\frac{1}{4\frac{1}{2}}$ $\frac{8}{10}$.

The severe reaction in this, and in the second eye of the first case, induced me to operate the two other cases without perforating the cornea. In both the reaction was mild and the result excellent, but in each the cauterization had to be repeated.

Case 4.—Miss M. L., about thirty-six years of age, of New York City, consulted me Febr. 10, 1892. Four years ago both eyes began to fail, the left more rapidly than the right. She had kerato-conus in both. With the right she read J1 at $2\frac{1}{2}$″, with the left barely at 1″. In the left the somewhat opaque cone was slightly below and outward from the centre of the cornea.

Febr. 29, 1892, I applied the oval electrode to the apex of the cone and withdrew it as soon as it had become red. No reaction. The cornea flattened so that she could recognize the time of my watch at 10″. She was discharged three weeks after the operation with a threatening tendency toward a relapse of the conical protrusion of the cornea. At the beginning of April she read No. 1 only at $1\frac{1}{2}$″. The cauterization, repeated in the same place, was followed by no reaction. The patient left the hospital a week later. The cornea flattened and sight improved steadily. May 4th she read No 1 at $3\frac{1}{2}$″. June 14th at 4″; with — 4.5 D $\frac{8}{10}$. The scar is sharply circumscribed. Sept. 17th, 1892, when she came again, she told me that the eye had given her no discomfort. Scar covering lower half of pupil. Semitransparent in ophthalmoscopy, some metamorphopsia through it, none

through upper part of pupil. S No. 1 at 10″; $\frac{10}{10}$ without glasses. With glasses no improvement.

Case 5.—Miss M. D., æt. twenty, of Tacoma, Wash., consulted me Mch. 8, 1892. Kerato-conus both, L more than R. L J1 at 1″, R J1 at 3″. High degree of OS metamorphopsia, and frequent pain in the depth and the surroundings of the eye.

March 10th, oval electrode applied to apex of cone in left eye, a little below centre of cornea, withdrawn when brought to red-heat. Great pain in eye the first night. Some swelling of conjunctiva and edge of upper lid. Eschar as usual. Cornea and iris unaffected. From second day freedom from pain. No reaction in wound; cornea flattening rapidly. She saw time at watch at 10″ and farther, counted fingers across the room. In the second week, cornea began to protrude again, and S diminished. March 23d, J1 at $2\frac{1}{2}$″. *Cauterization repeated.* Pain the first night. No discomfort later. Healing without reaction. Scar in cornea sharply defined, encroaching on the lower third of the pupil. Ophthalmoscopic metamorphopsia disappeared. Flattening of the cornea and improvement of sight continued for three months. She was discharged from the hospital April 4th, and left the city at the beginning of July. When examined at that time she read with the operated eye J1 at 10-12″, and saw $\frac{10}{10}$ with $-$ 3.D $-$ 1.$_{c}$ 25^{a}. I am informed by her physician that this good condition has remained.

REMARKS.

These six operations are, it seems to me, not without suggestive value. Galvano-cautery, at the present time, appears to be in greater favor than any other method, particularly in England. Yet, like all other procedures, it has its great dangers. If the cauterization is only superficial, or consists in a mere perforation of the apex, it is insufficient and has to be repeated.[1] If the cauterization is deep, especially with a larger perforation, the closure is slow, and the inflammation and its consequences may be more or less severe, including sloughing of the cornea. Anterior and posterior

[1] See two cases recently operated on in this way by a pupil of mine, Dr. R. D. Gibson, of Youngstown, O. Reported *Jour. Am. Med. Assoc.*, Sept. 10, 1892.

synechiæ are not infrequent, and may require an iridectomy, which also for optical purposes may be desirable in some cases. The removal of a piece of the protruding cornea by excision or trephining may yield good results—I have not learned in what percentage,—but I know, not from my own experience, that eyes have been lost by panophthalmitis following this procedure. The cauterization, which acts by the contraction of the cicatrix, seems to be the safest method. Galvano-cautery is, in my opinion, preferable to the lunar caustic of Von Gräfe. Perforation of the cornea with its consequences, anterior and posterior synechiæ, may be avoided, as our last two cases show. Better to cauterize carefully and, if relapses occur, repeat the operation on the same place. The scar is well circumscribed and an iridectomy useless. The oval electrode seems a good instrument. The last case is a particularly remarkable example of smooth healing and almost perfect success in the treatment of this dreaded disease.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY DURING THE THIRD AND FOURTH QUARTERS OF THE YEAR 1891.

By Dr. ST. BERNHEIMER, in Vienna; Prof. Dr. HORSTMANN, in Berlin; and Dr. SILEX, in Berlin.

WITH THE CO-OPERATION OF

Dr. S. M. Burnett, Washington; Dr. Dantone, Rome; Prof. Dr. Hirschmann, Charkow; Dr. E. Marckwort, Antwerp; Dr. P. von Mittelstädt, Metz; Dr. Werner, Dublin; Dr. C. H. A. Westhoff, Amsterdam; Dr. Schiötz and Dr. Ole Bull, Christiania; and Dr. Deus, Berlin.

Translated by Dr. Jas. A. Spalding.

Sections XII.–XXI. Reviewed by Dr. P. SILEX.

XII.—IRIS.

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432. Purtscher. On a new form of anterior synechia following blunt force. *Centralbl. f. Augenhlkde.*, vol. xv., p. 327.

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438. Schenk. Ice in iritis. *Journ. Ophthal., Otol., and Laryngol.*, Oct., 1891.

439. Bissell. Spasm of the ciliary muscle. *Journ. of Ophth., Otol., and Laryngol.*, Oct., 1891.

440. Cassedy. Congenital corectopia. *Journ. Ophth., Otol., and Laryngol.*, July, 1891.

In cases of detachment of the iris at the periphery as the result of a blow, Smith (431) makes an incision into the cornea above the site of the prolapse, and introducing a pair of iris forceps, draws the detached edge of the iris into the incision, which usually holds it in place; should it not be retained, a delicate suture can attach it to the neighboring conjunctiva. Three cases have been so treated. Burnett.

Purtscher's case (432) was one of an extensive and almost circular, though somewhat irregular, synechia, united with the cornea. The pupillary margin and the periphery of the iris were perfectly free, and the cornea intact.

Herrnheisser (433) reports two clinical cases, and gives a detailed view of all the theories concerning the origin of iris cysts. The original cause of those that appear spontaneously is still obscure.

Charnley's patient (434), a boy of sixteen, had a small unpigmented neoplasm on the interior and inner margin of the pupil. This was removed by an iridectomy, and proved to be a very vascular tumor, which had become sarcomatous. Werner.

Gillet de Grandmont (436) declares that it is impossible, from condylomata of the iris, and, on the whole, from the ocular disease itself, to decide whether the case is one of tuberculous or of syphilitic origin. There are many exceptions to the general law that the syphilitic condylomata lie upon the pupillary margin, and the tuberculous upon the peripheral portion of the iris. He cites a case in which he was sure from the history that syphilis was at work, yet in which the autopsy demonstrated tuberculosis. Marckwort.

In the Charity Hospital in New York, Roy (437) found, among 61 patients admitted for syphilis, from February 15th to April 1st, 14 who had iritis—5 women and 9 men. Burnett.

Schenk (438) has found the constant application of ice most

beneficial, not only in the traumatic but also in the idiopathic form of iritis. BURNETT.

CASSEDY (440) reports a case of corectopia in which the pupil was drawn downward and inward. No coloboma of choroid, or any other bodily deformity. He has a son who is similarly affected in the left eye. BURNETT.

XIII.—CHOROID.

441. SATTLER. A case of bacillus panophthalmitis. *Ber. d. Ophth. Ges. zu Heidelberg*, 1891. *Archiv. f. Augenhlkde.*, vol. xxiv., 2, p. 72.

442. STORY. Detachment of the choroid. *Trans. Ophth. Soc. U. K.*, vol. xi., p. 127.

443. LEBER. On the coincidence of disseminated choroiditis and hemorrhagic retinitis, or retinal hemorrhages, in the same eye. *Festschrift zur Feier von Helmholtz*, 1891.

444. CARPENTER. Tuberculosis of the choroid ; a further contribution. *Brit. Med. Jour.*, July, 1891, p. 66.

445. KNAPP. Contribution to the tuberculosis question. *v. Helmholtz Festschrift*, 1891.

446. LEBER. On weakened tuberculosis of the eye. *Ber. d. Ophth. Ges. zu Heidelberg*, 1891. *Arch. f. Augenhlkde.*, vol. xxiv., 2, p. 68.

447. HAAB. Some rare ophthalmoscopic images. (1) Chronic tuberculosis of the choroid. (2) Specific arterial disease of the retina. *Festschrift v. Helmholtz*, 1891.

448. HILL-GRIFFITH. The prognosis of choroidal sarcoma. *Ophth. Rev.*, vol. x., p. 353, and *Brit. Med. Jour.*, Sept., 1891, p. 590.

449. LAWFORD and COLLINS. Sarcoma of the uveal tract, with notes of one hundred and three cases. *Royal London Ophth. Hosp. Rep.*, vol. xiii., p. 104.

450. SAMELSOHN. Metastatic carcinoma of the choroid. *Deutsch. med. Wochensch.*, 1891, p. 927.

451. UHTHOFF. On the doctrine of the metastatic carcinomata of the choroid. *Festschrift Virchow*, vol. ii. Berlin, Hirschwald, 1891.

452. WOOD, T. H. Ossification of the choroid. *Ophth. Rec.*, July, 1891.

STORY'S (442) patient, a man of twenty-seven, reported that when a child he had received injuries on both orbits, but no direct injury of the eyes themselves. Both eyes revealed extensive detachment of the retina, beneath which, with the same convex lens, the stroma of the choroid could be distinctly seen.

WERNER.

LEBER (443) is of the opinion that, in the cases in question, the damage, which is mainly to be sought for in microbic excitation, may have been carried into the eye by means of the blood-vessels or lymphatics. The picture varies, depending upon whether the choroid or the retina is affected. In the latter case we find plugging of the vessels, circulatory disturbances and hemorrhages, whilst in the former, owing to the numerous anastomoses, inflammatory alterations (choroiditis adhæsiva) predominate. Two cases are closely described. Occasionally the extravasations are so extensive that they bear great resemblance to the recurrent vitreous hemorrhages in young persons, in whom he was repeatedly able to establish the seat of the hemorrhage in the retina.

CARPENTER'S (444) cases were two each of general and of localized tuberculosis. The tubercles of the choroid were seated near the papilla and macula, and varied in size, one of them being several papilla-diameters across. They were gray and pale, and slightly elevated. WERNER.

HAAB (447) calls attention to the fact that syphilitic disease of the arteries may be confused with sclerosis of the arteries, with retinal striæ after chronic chorio-retinitis, and with obstruction of an arterial branch by an embolus.

GRIFFITH (448) reports the case of a man of sixty, whose eye was enucleated in a glaucomatous condition owing to an intra-ocular tumor, and who was affected with metastasis in the liver on the sixty-second day, and finally died about one year after the first symptom of failing vision. There have been seen at the Eye Hospital in Manchester in the last eight and a half years 40 cases of choroidal sarcoma; 25 in men and 15 in women. The percentage of such cases amongst all the eye cases seen in the hospital was 0.03. Fourteen of the 40 cases were alive from 3 to 10 years after the operation of enucleation, and can therefore be regarded as definitely cured (?—H. K.). Six died of diseases of the internal organs, and in 3 the cause of death was a matter of doubt. The remaining cases could not be followed. This gives 60 per cent. of recoveries. Griffith believes that the time at

which the enucleation is performed is of but little, if any, influence upon the metastasis. WERNER.

The cases of sarcoma of the uveal tract collected by LAWFORD and COLLINS (449) were, with a few exceptions, treated at Moorfields. Amongst the 103 cases there were 59 men. The average age was 48 ; the youngest 15, the oldest 84. Fifty per cent. of the cases with increased tension, and 34 with tension not increased died. Six tumors of the ciliary body, 2 of the choroid and ciliary region, and 1 of the iris were observed. There was no constant relation between the form and arrangement of the cells and the further course of the case. Of 79 cases which could be followed, 39 remained alive, 20 for more than 3 years after the removal of the neoplasm, which gives 25 per cent. of recoveries. Eight that were followed up to the time of their death lived more than 3 years after the operation. Of the 26 patients who died from metastasis, the average duration of life after the operation was 2 years and 7 months. Of 79 cases observed for some time after the operation, 7 had local relapses, and all of them died. An injury could be traced in 5 cases, and in 6 the eye was blind from some other cause.

In WOOD'S case (452) a woman of twenty-seven had lost the left eye from inflammation when five years old. Eye more or less painful at times ever since. Some symptoms of sympathetic irritation in R, which caused the left to be enucleated. On examination the inner layer of the choroid was found to be replaced by a shell of bone, pierced behind for the admission of the head of the optic nerve. The shell extended forward to near the equator. Retina detached ; lens displaced and calcareous. Sympathetic irritation subsided. BURNETT.

XIV.—GLAUCOMA.

453. CROSS. Hydrophthalmus. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 224.

454. JULER. Double congenital buphthalmus. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 240.

455. KALT. Pathological anatomy of buphthalmus. *Cong. franç. d'Opht.*, May 5, 1891, and *Ann. d'Ocul.*, vol. cv., p. 225.

456. KNIES. Glaucoma simplex. *Ber. d. Ophth. Ges. z. Heidelb.*, 1891, and *Archiv. f. Augenhlkde.*, vol. xxiv., No. 2, p. 69.

457. RANDOLPH. Hemorrhagic glaucoma, with an analysis of three cases. *Jour. Amer. Med. Assoc.*, Sept., 1891.

458. COLLINS. On the operative treatment of glaucoma. *Royal London Ophth. Hosp. Rep.*, vol. xiii., p. 166.

459. WAGNER. On the question of the curability of glaucoma. *Wjestnik Ophth.*, 1892, No. 3.

460. LLOYD. An acute glaucomatous attack in the right eye of a colored man, æt. twenty-four. Left eye destroyed six years previous by a pistol-ball. Removal of eye. *Amer. Jour. Ophth.*, July–August, 1891.

461. DE SCHWEINITZ. Perimetric observations on the influence of eserine and iridectomy in chronic glaucoma. *Jour. Amer. Med. Assoc.*, Sept., 1891.

CROSS (453) gives profuse literary references, and mentions seven different cases of hydrophthalmus, and one case of glaucoma in a patient aged twenty-seven.

JULER (454) performed paracentesis in an eye, with slight improvement. The cornea of the other eye was already perforated, and enucleation was performed. The results of the examination are detailed. WERNER.

According to KALT'S anatomical investigations (455) buphthalmus is the sequence of a chronic irido-choroiditis, which leads to a gradual obliteration of the vessels of the uveal tract. The obstruction of the largest portion of the choroidal capillaries increases the pressure in the ciliary arteries, from which arises increased transudation of fluid. MARCKWORT.

RANDOLPH (457) reports three cases of typical hemorrhagic glaucoma, which he has treated with iridectomy and paracentesis. The results were so successful that he concludes that iridectomy is not, as is generally held, a *contra*-indication, but, on the contrary, useful in giving temporary, at least, and in many cases a permanent relief. He would follow the iridectomy up with paracentesis for relief of subsequent symptoms. BURNETT.

COLLINS' paper (458) describes the results of the examination of 23 eyes which had to be enucleated after glaucoma operations. Micro-photographic illustrations are appended. In every case of iridectomy the incision was oblique, especially when a keratome was used. In only 2 cases was the ligamentum pectinatum injured by the incision. In every case but 4 there remained a bit of iris standing, which with one exception was adherent to the

cornea. In 2 cases in which sclerotomy had been done, cystoid cicatrices, filled with atrophic iris tissue, were discovered. The author advises an early operation before any adhesion originates between the iris and cornea. WERNER.

WAGNER (459) opposes the pessimistic views of Logetschnikoff, and considers that a carefully performed iridectomy is positively curative, even in glaucoma simplex or hæmorrhagicum. HIRSCHMANN.

In LLOYD'S case (460) an acute glaucoma developed in an eye whose fellow had been lost six years before. The lost eye was removed, and the glaucoma disappeared with no other treatment than eserine. He considered it due to sympathetic influence. BURNETT.

DE SCHWEINITZ'S cases (461), four in number, while carefully reported, do not throw a great deal of light upon the question of how to deal with what is called chronic simple glaucoma. In the cases reported, the visual field was somewhat enlarged under the use of eserine or pilocarpine in weak solutions, and in one instance an iridectomy was done. But in nearly all of the cases tonics, and especially strychnia, were used internally. BURNETT.

XV.—SYMPATHETIC OPHTHALMIA.

462. BRAILEY. On sympathetic ophthalmia. *Verhand. d. XI. Int. Med. Cong.*, 1890, vol. iv., 4, p. 109.

463. TROUSSEAU. A case of sympathetic ophthalmia occurring despite resection of the optic nerve. *Soc. Opht. de Paris*, April 7, 1891.

464. HIRSCHBERG. Sympathetic blindness permanently cured. *Centralbl. f. prakt. Augenhlkde.*, vol. xv., p. 289.

465. BOÉ. On sympathetic ophthalmia. *Cong. Franç. d' Opht.*, May 5, 1891, and *Rec. d'Ophtal.*, 1891, p. 336.

466. MANARA. Sympathetic ophthalmia. Rome, Marianie, 1891.

467. SCHMIDT-RIMPLER. A contribution to the origin of sympathetic ophthalmia. *Ber. d. Oph. Ges. zu Heidelberg*, 1891, and *Archiv. f. Augenhlkde.*, vol. xxiv., 2, p. 70.

TROUSSEAU'S case (463), of sympathetic ophthalmia despite a previous resection of the optic nerve, was discussed before the Ophthalmological Society of Paris. Wecker attempts to defend

the resection of the optic nerve. Sympathetic ophthalmia has also been observed after enucleation. Meyer is of the opinion that Trousseau's case is a powerful argument against resection. Despagnet, Gorecki, and Parinaud had seen a favorable influence upon, and even a rapid cure of, the sympathetic inflammation after enucleation, even when the sympathy had already been well marked for ten days or even several weeks before the enucleation. Boucheron also was very emphatically in favor of the therapeutic as well as of the prophylactic value of enucleation. MARCKWORT.

HIRSCHBERG's patient (464) had suffered with a perforating corneo-scleral injury of the left eye. About six weeks later iridochoroiditis of the fellow eye ensued. Enucleation of the left eye; inunction and darkness treatment; atropine. At one time increased tension; later decrease of the same. Twelve weeks later blindness by increased tension. The blindness gradually diminished, and vision increased to $\frac{1}{3}$. The vision later increased so much that the patient is hard at work as a carpenter. The iris is of course adherent, the optic papilla discolored, and the choroid exhibits patches. Iridectomy was not performed.

BOÉ (465) carried out a series of experimental investigations in regard to panophthalmitis. He also watched to see if sympathetic ophthalmia would appear, but never discovered any trace of the same. Even the optic nerves, when microscopically examined, were quite normal. Boé thinks that Deutschmann's investigations fail to prove that the sympathy is a migratory ophthalmia. Deutschmann's experimental animals all died from general infection. Hence it was a matter of course that micrococci were discovered in the optic nerves. MARCKWORT.

MANARA (466) has made numerous experiments on rabbits to discover the propagation paths of sympathetic ophthalmia, but failed to find any confirmation of Deutschmann's views. Vitreous inoculation of staphylococcus aureus and albus and streptococcus pyogenes, in healthy as well as in eyes irritated by the introduction of an aseptic body, produced the unvarying infectious inflammation. But the healthy eye invariably remained normal, and not a trace of micro-organisms could be discovered in the optic-nerve sheaths of the inflamed eye. The proof was attempted with cultures, as well as with the aid of the microscope. The author therefore believes that the healthy eye will only be affected when a general constitutional effect has been produced by the inoculation. DANTONE.

XVI.—VITREOUS.

468. VAN DUYSE. Persistence of Cloquet's canal. Remains of the fœtal hyaloid system. Coloboma of the optic nerve. *Arch. d'Opht.*, vol. xi., 5, Oct., 1890, p. 404.

469. PRICE. Persistent hyaloid artery. *Ophth. Record*, Aug., 1891.

470. COLLINS. A late epithelial implantation cyst in a shrunken globe twenty-eight years after the receipt of the injury. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 133.

471. HIRSCHBERG. Bloody myodesopsia. *Centrabl. f. Augenhlkde.*, vol. xv., p. 242.

VAN DUYSE (468) observed in the left eye of a patient, aged nineteen, the persistence of Cloquet's canal and remains of the hyaloid artery. Whilst all the hitherto reported cases of Cloquet's canal were observed in *both eyes*, and the hyaloid artery in one eye only, here were found both anomalies in the *one eye*, and the other eye was absolutely normal. Together with the canal arising from the neighborhood of the papilla, and enclosing the remnants of the vessel, which passed through the vitreous, but did not attach itself precisely to the centre of the posterior of the capsule of the transparent lens, but a little to one side, there were visible: (1) a white disk covering the papilla and its vessels, which, directed downward and outward, resembles at its lower extremity a choroidal coloboma, and is surrounded with choroiditic patches; (2) a coloboma of the optic-nerve sheath, in the form of a conus upward. The author describes all with many details, and makes comparisons with the cases hitherto reported.

MITTELSTÄDT.

PRICE (469) reports an interesting case of persistent hyaloid artery, in which the vessel could be followed from the central retinal artery to the rear of the posterior lens capsule, where it spread out in ramifications not unlike those of the retinal vessels. The other eye contained traces of a hyaloid artery.

BURNETT.

In COLLINS' case (470) the eye was enucleated twenty-eight years after an injury. A large cyst occupied nearly the whole of the interior of the globe. It was lined with pavement epithelium, and extended as far as a cicatrix in the cornea. WERNER.

XVII.—LENS.

472. BRAILEY. On some points in the development of cataract. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 66.

473. FUCHS. On lens precipitates. *Beitr. z. Augenhlkde.*, Heft iii., Hamburg.

474. MULES. Anterior central capsular and pyramidal cataracts; their pathology. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 70.

475. RISLEY. Incipient cataract; its etiology, treatment, and prognosis. *Ophth. Rev.*, vol. x., p. 225.

476. SCHIRMER. On the pathological anatomy and pathogenesis of central cataract. *v. Graefe's Archiv.*, vol. xxxvii., 4, p. 1.

477. WILSON, H. Hereditary congenital cataract. *Jour. Ophth., Otol., and Laryngol.*, Oct., 1891.

478. UHTHOFF. Examination of the visual learning of a child of seven, born blind, but successfully operated. *v. Helmholtz Festschrift*, 1891.

479. MACNAMARA. The treatment of infantile cataract. *Brit. Med. Jour.*, Sept., 1891, p. 589.

480. DUB. Contribution to the knowledge of zonular cataracts. *v. Graefe's Archiv.*, vol. xxxvii., 3, p. 26.

481. WRAY. Points in the treatment of lamellar cataract. *Ophth. Rev.*, vol. x., p. 263.

482. COLLINS. Extensive rupture of the posterior capsule of the lens following a blow on the eye from a stone. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 126.

483. HAAB. Remarks on cataract operations. *Beit. z. Augenhlkde.*, vol. iii., Hamburg, 1891.

484. CROSS. Iridectomy or no, in cataract extractions. *Brit. Med. Jour.*, 1891, p. 472.

485. BARR. Extraction of incipient cataract. *N. Y. Med. Rec.*, Dec. 12, 1891.

486. MURELL. To what extent are personal restraints essential during healing of corneal wounds? *Amer. Jour. Med. Assoc.*, Aug. 29, 1891.

487. ROSMINI. One hundred and nine simple extractions. *Boll. d'Ocul.*, vol. xiii., p. 13.

488. NIKOLJUKIN. Report of ninety-seven cataract extractions. *Westjn. Ophth.*, May and June, 1891.

489. MACNAMARA. Address in section of ophthalmology at British Medical Association meeting, 1891, on certain points in ophthalmic practice. *Brit. Med. Jour.*, 1891, p. 251.

490. BERRY. Note on an unusual result of cataract extraction. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 152.

491. MARTIN. A post-operatory complication of a Morgagnian cataract. *Soc. Opht. de Paris*, Nov. 3, 1891.

492. SANTOS FERNANDEZ. On a possible, but remedial, accident in keratotomy. *Rev. Gén.* 1891, p. 337.

493. GAUPILLAT. New device for bandaging after simple extraction. *Rev. Gén. d'Opht.*, 1891, p. 939.

494. PARINAUD. Prolapse of iris in simple extraction. *Rec. d'Opht.*, 1891, p. 321.

495. GAYET. Essay on the investigation of the acuteness of sight after the operation for cataract. *Festschrift v. Helmholtz*, 1891, p. 62.

496. OSTWALT. A few words on the correction of aphakia with lenses. *Zehender's Monatsblaetter*, 1891, p. 223.

497. KNAPP. The treatment of the capsule during and after the extraction of cataract. *Trans. of the Xth Int. Med. Cong.*, vol. iv., 4, p. 1.

498. SMITH, E. How shall we treat the capsule? A new cystitome forceps. *Jour. Amer. Med. Assoc.*, Nov., 1891.

499. POOLEY. Operation for secondary cataract, with subsequent iridocyclitis and glaucoma. *Amer. Jour. Ophth.*, Dec., 1891.

500. THOMPSON. Note on Foerster's artificial ripening of cataract. *Royal London Ophth. Hosp. Rep.*, vol. xii., p., 33.

501. SEABROOK. The natural course of cataract. *Med. Rec.*, Sept. 12, 1891.

502. RODES. Spontaneous extraction of a cataractous lens. *Jour. Ophth., Otol., and Laryng.*, July, 1891.

503. FROTHINGHAM. Remarks on the need of more efficient protection of the eye after cataract extraction, and an improved apparatus for the purpose. *Jour. Amer. Med. Assoc.*, Aug. 29, 1891.

504. JACKSON. Pressure on the globe after cataract extraction. *Jour. Amer. Med. Assoc.*, Aug. 29, 1891.

BRAILEY's paper (472) contains statistics derived solely from private practice. He finds that 7 per cent. of patients exhibited lental opacities. In 14 per cent. of all the cataract cases, at least one lens was sufficiently mature for extraction. The majority seem to undergo little change for the worse. Of 30 such cases observed from three months up to eight years, 14 remained absolutely stationary; 4 got slightly better. The slight improvement sometimes remains permanent. Nuclear cataracts progress in spite of any precautions, while peripheral cortical ones may be to a certain extent checked by rest and hygienic measures. The latter form is generally accompanied with distress on using the eyes. WERNER.

MULES (474) concludes that pyramidal cataract is an unabsorbed portion of capsulo-pupillary membrane. He relates an instance in which remains of pupillary membrane adhere to such a cataract, and alludes to the fact that in a great many cases no trace of opacity can be detected in the cornea, which could scarcely be the case if it had been ulcerated. Mackinley observed that in nearly all these cases there was a history of purulent ophthalmia. WERNER.

From a study of his cataract cases RISLEY (475) concludes that, whilst opacity of the lens is a disease of advanced life, it does not in all probability depend upon senile changes, but originates in local pathological conditions involving the nutrition of the eye itself. This disease is usually a form of choroiditis, and it is facilitated by uncorrected ametropia. BURNETT.

SCHIRMER (476) examined five cases of central cataract, *i. e.*, small, knobby, intensely white or yellow, translucent or opaque, centrally situated congenital opacities. Clinically these cataracts are likely to be confounded with thick zonular cataracts. Anatomically it appears that both are undoubtedly zonular cataracts with delicate opacity of the nucleus. Adjacent to the transparent cortical layers, lies an oval band of minute drops, which encloses the sharply defined nodule embracing in its fissures a coarsely granular mass. Central cataract is referred to an unknown intrauterine influence, which leads to the appearance of drops amid the fresh fibres, around which, later, transparent lens substance is deposited.

WILSON (477) gives the history of hereditary cataracts in the

descendants of one who suffered from this affection. Of the 31 descendants to the fourth generation, 16 were affected with congenital cataract, males and females in equal proportion.

BURNETT.

MACNAMARA (479) expresses the opinion that in children the operation for cataract should be undertaken as soon as the child has finished teething. Needling, with subsequent linear extraction was the method that he invariably employed. McHardy also believed in the early operation, as there was less resulting irritation in young children. He had abandoned suction, as he found it unnecessary. The presence of peripheral striæ in zonular cataract indicated, in his opinion, a progressive tendency. Argyll-Robertson had also abandoned suction. In many cases he performed iridectomy or iridodesis.

After a series of measurements, DUB (480) came to the conclusion that lamellar cataracts, or at least a large majority of the same, originate in the first months of life, or even are of intrauterine origin.

According to WRAY (481) operation for cataract should not be delayed in infants if a coarse view of the fundus is not possible under atropine. Discission is advisable up to thirty-five years of age. In a large number of cases, uniocular operations suit the patients' requirements best.

In COLLINS' case (482) the eye was enucleated for a perforating wound with prolapsed iris. Although the lens was perfectly clear, a large rent, with protrusion of lens fibres, was found in the posterior capsule a week after the injury. WERNER.

The most important point to be gained from HAAB'S paper (483) is that he operates on cataract patients affected with dacryocystoblennorrhœa, after completely occluding the puncta with the galvano-cautery, and strewing pulverized iodoform into the conjunctival sac. He exercises the greatest precautions to procure the most exact asepsis and antisepsis.

CROSS (484) is convinced that healing takes place more rapidly under simple extraction. In 62 cases iridectomy was performed six times to facilitate the extraction. There were 5 cases of prolapse or protusion of vitreous, 4 prolapses of iris, and 11 anterior synechiæ, 5 of the latter being very slight. No suppuration. Two cases of hypopyon, which recovered. Two slight cases of iritis.

BARR (485) gives statistics of fourteen successful extractions

of incipient cataract. He always removes a large portion of the anterior capsule. BURNETT.

MURELL (486) believes in allowing cataract patients the greatest liberty after the operation. He operates in his office, and allows the patients to walk home. The patient is not confined to bed, nor is the unoperated eye closed. This plan followed for two years has not been interfered with by any serious accidents. BURNETT.

From ROSMINI'S (487) paper we learn that in 109 cataract extractions he has operated, without iridectomy, on 6 that were immature, and with good success.

Fifty-eight extractions with the capsule (13 times with a large and 15 times with a small loss of vitreous) gave NIKOLJUKIN (488) good vision in 31 per cent., moderate in 48 per cent., fingers from 2 to 4 *m* in 17 per cent., and S = 0 in 3½ per cent. In 39 other extractions he had considerable loss of vitreous twice, and slight loss three times, occlusion of the pupil once, panophthalmitis once, and secondary cataract twice. HIRSCHMANN.

MACNAMARA'S (489) address includes remarks on the extraction of immature cataract, and hypermetropia in relation to glaucoma. He mentions 3 cases of optic neuritis as a consequence of the influenza, one patient becoming blind from optic atrophy. WERNER.

BERRY'S patient (490) had an epileptic seizure the first night after the operation, which led to intraocular hemorrhage, pain, nausea, and vomiting. There was an escape of fluid vitreous during the extraction. WERNER.

MARTIN (491) operated upon a Morgagnian cataract in the following manner: section in the limbus, small conjunctival flap, and equatorial opening of the capsule. The moment that this step was accomplished, the lens shot out of the eye with such force that it flew an entire metre. Although after the operation the sphincter was free, three days later a hernia of the iris had to be snipped off. The recovery was extremely slow, with the formation of a large cystoid cicatrix. The explanation of this curious case was not discovered till seventeen years later, when the same patient came for an operation on the other eye, which was totally blind from absolute glaucoma. Martin made an iridectomy on this eye at once, but on the following day found the lens lying in the incision, and thereupon removed it without any difficulty. MARCKWORT.

SANTOS FERNANDEZ (492) describes the routine to be followed when, by an error in cases of extraction, the narrow v. Graefe knife is inserted with the back upward. He urges that the knife should not be withdrawn, but turned around *in loco.*[1]

GAUPILLAT (493) affirmed in the beginning of his paper that prolapse of iris had decreased since the re-introduction of Daviel's extraction without the iridectomy. (He is here in opposition to most of the French oculists, who urge as one of the chief disadvantages of simple extraction the greater frequency of prolapse of the iris.—Reviewer.) The stress of Gaupillat's article is laid on the best way of applying the bandage. The wadding should only be laid upon the upper lid, and upon this only, so far as just to cover the eyelashes. In this way he asserts that prolapse of iris is best avoided. MARCKWORT.

According to PARINAUD (494), the chief arguments against simple extraction are the greater difficulty in removing the cortical masses, the greater percentage of secondary cataracts, and the greater ease with which the iris prolapses. If the iris does not remain perfectly round after the extraction, or after it has been replaced with the spatula, we should not hesitate to make an iridectomy. If there is a secondary prolapse, we can do an iridectomy twenty-four hours after the extraction. But later the prolapse should be destroyed with the galvano-cautery.

MARCKWORT.

OSTWALT (496) urges, with Dimmer, that when we are obliged to order compound lenses after an extraction the cylinder should be placed nearest to the eye.

KNAPP (497) prefers the so-called peripheral opening of the capsule, because in this way the pupillary field continues free of inflammatory products, and the remaining capsule is better suited for the secondary discission. The latter he performs, when necessary for improved vision, just as soon as the globe is free from irritation, anywhere from three to seven weeks after the primary extraction, and he does this with a needle-knife in the form of a T-shaped or cruciform incision of the capsule by artificial illumination. The operation, with proper antisepsis, is free from danger, and generally doubles the amount of vision.

SMITH'S (498) forceps are a modification of Knapp's, there being three or four teeth instead of four to five, and these are

[1] This accident has occurred a few times, and was remedied by simple turning of the knife. No reaction followed. Compare my earlier reports.—H. K.

sharp only at the point, in order that they may sink into the capsule, and tear it, but not cut it. The curving of the blade is such that the teeth may be set down into the pupillary space without tilting the forceps or grasping the iris. BURNETT.

POOLEY (499) reports a case in which an operation for discission of a secondary cataract, which had formed without any inflammation, by means of a Knapp needle-knife, was followed by inflammatory and glaucomatous symptoms. The capsule was tough and rather hard to cut, and some vitreous escaped. The patient made a good recovery. BURNETT.

THOMPSON (500) observed in one case that vision was reduced to fingers at three feet from the increasing opacity after Foerster's method, but that the lens gradually began to clear until the patient could read moderate-sized type. WERNER.

SEABROOK (501) concludes from a study of his own and others' materials: (1) that it is the rule for senile cataracts to show improvement at some time in their course; (2) that it is exceptional for pathological changes to remain absolutely stationary, permanently to improve, or to disappear. He does not believe that any true senile cataract has ever been arrested under the influence of any medical treatment whatsoever. BURNETT.

RODES (502) made a preliminary iridectomy, and the incision healed nicely without inflammatory symptoms. About a month later the lens was found in the anterior chamber, and pressing against the cicatrix. This gradually yielded, and the lens was extruded, leaving, the writer states, very good vision.

BURNETT.

FROTHINGHAM (503), after pointing out the inefficacy of most of the methods of dressing the eye after cataract extractions, describes a new mask, which he has devised for protecting the eye after the operation. It can be used over any kind of dressing. (Used very extensively by Fuchs in Vienna.—H. K.)

JACKSON (504) concludes, from a study of the physics involved, that any pressure on the globe after an extraction tends to cause a displacement of the edges of the wound, and that therefore, in dressing all these eyes, all pressure should be avoided.

BURNETT.

XVIII.—RETINA AND FUNCTIONAL DISTURBANCES.

505. VAN FLEET. Retinitis albuminurica and pregnancy. *Med. Jour.*, 1891, Sept. 26th.

506. OSTWALT. Syphilitic retinitis and its relations with the retinal arteries and with syphilitic arteritis of the encephalon. *Thesis*, Paris, 1891.

507. WAGENMANN. Contribution to our knowledge of the pathological anatomy of retinitis pigmentosa. *v. Graefe's Archiv.*, vol. xxxvii., p. 1.

508. RANSOHOFF. Retinitis pigmentosa. *Zehender's klin. Monatsbl.*, xxix., p. 271.

509. DE BONO. Investigations into the alterations of the retinal epithelium, and particularly on the formation of the so-called colloid excrescences. *Ann. di Ottal.*, vol. xx., 4, p. 329.

510. STEPHENSON. A peculiar form of retinal pigmentation. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 77.

511. VAURELLE. Contribution to the study of the etiology of epidemic hemeralopia, and of its relations to scurvy. *Thesis of Bordeaux*, 1891.

512. MANZ. Examination of a case of embolism of the central retinal artery. *Deutsch. med. Wochensch.*, 1891, p. 884, and *Festschrift v. Helmholtz*, 1891.

513. NETTLESHIP. Unusual appearances in a case of retinal embolism about thirty hours after its occurrence. *Festschrift v. Helmholtz*, 1891.

514. BARATZ. A case of embolism of the central retinal artery, with unusual appearances in the fundus of the eye. *Wratsch.*, 1891, no. 29.

515. GUNN. A case of hemorrhagic disease of the retina. *Festschrift v. Helmholtz*, 1891.

516. MUGLICH. Spontaneous recoveries from retinal detachment. *Inaug. Dissertation*, Marburg, 1891.

517. MACKROCKI. On the symptomatology of commotion of the retina. *Archiv. f. Augenhlkde.*, vol. xxiv., 3, p. 244.

518. MEYER. Contribution to the ophthalmoscopic diagnosis of alterations in the vascular walls in the retina. *Festschrift v. Helmholtz*, 1891.

519. PERLES. Glioma of the retina. (Observation in a very early stage.) *Centralbl. f. Augenhlkde.*, vol. xv., p. 240.

520. LAWFORD and COLLINS. Notes on glioma retinæ, with a report of 60 cases. *Royal London Ophth. Hosp. Rep.*, vol. xii., p. 12.

521. HILBERT. Pathology of scintillating scotoma. *Centralbl. f. Augenhlkde.*, vol. xv., p. 330.

522. FISCHER. Contraction of the visual field in traumatic neurosis. *Archiv. f. Augenhlkde.*, vol. xxiv., p. 18.

523. SAMELSOHN. On anæsthesia of the retina. *Deutsch. med. Wochensch.*, 1891, p. 927. (Regards the disease as central.)

524. JESSOP. Two cases of complete blindness with good pupillary reflexes. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 227.

525. WILLBRAND. On alterations in the visual field in functional disturbances of the nervous system, and on the oscillating visual field. *Verh. d. X. Internat. Med. Congr.*, vol. iv., 4, p. 101.

VAN FLEET (505) reports four cases of albuminuria in pregnancy, accompanied with retinitis, in three of which the termination was fatal, and in the fourth case a miscarriage fortunately occurred, and saved both the life and the sight of the patient. He strongly recommends the production of abortion in such cases.

BURNETT.

OSTWALT (506) describes the syphilitic diseases of the retina and choroid, and appends extensive literary references. Syphilis of the retina exhibits itself first in the central portions. The never-failing fine vitreous opacities of the authorities, Ostwalt asserts, never or rarely to have seen. If neglected, the eye gradually falls a prey to the usual type of syphilitic chorio-retinitis. Later we see Huebner's disease of the cerebral arteries, which bears great resemblance to the alterations in the retinal arteries. If the treatment is energetically followed up at the time of the central retinitis, the results are likely to be excellent, but if neglected till the later stages the chances are less. For this reason it is of the greatest importance to be able to recognize the incipient stages of the disease. MARCKWORT.

In WAGENMANN'S (507) case of retinitis pigmentosa the retina was enormously thickened, degenerated into connective tissue, and at many spots intimately united with the choroid. The vascular walls and obliterated vessels contained pigment. Pigment-cells issued arc-like from the pigment epithelium into the retina. The greatly thickened choroid showed distinct sclerosis of the vessels. Proof of the hæmatogenous origin of the pigment could not be obtained. He thinks that the pigment originated exclusively from the pigment epithelium.

De Bono (509) investigated in eight eyes that had been enucleated for various diseases, the alterations in the retinal epithelium, and the formations of the so-called colloid excrescences of the choroid. He convinced himself that the latter are of epithelial origin, due to separation of the epithelial cells, or to colloid or hyaline degeneration of the same. He cannot think of these as senile alterations, because he once found them in a child of five. The influence upon the vision is slight, since the structures mostly develop in the region of the ora serrata.

Dantone.

Stephenson (510) records three cases (out of 2,500 eyes) of peculiar spotted pigmentation of the retina similar to that shown in Plate 76 of Jaeger's *Hand Atlas*. The author believes that the condition is a physiological one, that it is not attended with any abnormity in the function of the eyes, such as night-blindness, but that it is merely an exaggerated form of the small isolated pigment spots that he has found in eight per cent. of all healthy eyes. Werner.

Vaurelle (511) made a two-years' sea voyage, and six months after the departure from France there was a great scarcity of fresh meat. Fresh vegetables had long since disappeared. Eight men of the crew were affected with hemeralopia, but were quickly relieved by small doses of cod-liver oil. The same conditions arising later on in the voyage were treated successfully in the same manner. Werner.

The most remarkable point in the case of retinal embolism reported by Manz (512) was the imperfect atrophy extending over the inner layers only of the retina.

The unusual circumstance in the eye of a patient examined by Baratz (514) three days after blindness due to embolism of the central retinal artery, consisted in a movement of the blood in the vessels, distinctly visible in the erect image. It was centripetal in the veins, and centrifugal in the arteries. But in some of the arteries it was centripetal, a circumstance never before described except by Hirschberg. The movement was slow, and by starts. The author endeavors to explain the peculiarity of these movements by the anastomoses of the branches of the central retinal artery with Zinn's Vascular Circle, from which the blood can occasionally penetrate into some of the branches of the occluded artery nearest the capillary anastomosing network, and will then of course move in a centripetal direction.

MUGLICH (516) has collected 136 cases of spontaneous replacement of retinal detachments, in which no operation was performed, and in which the causation was to be referred to myopia, retinitis albuminurica, traumatism, phlegmon of the orbit, loss of vitreous after operations, and choroiditis. He also adds five new cases, and two post-mortem examinations of eyes in which the retina had replaced itself. The essence of the microscopic investigation lies in an excessive connective-tissue degeneration, especially of the external layers of the retina, and disappearance of the nervous elements. Additionally he discovered varicose nerve fibres, enormous pigmentary invasion of the retina, deposits of exudation, formation of cavities, and finely fibrous deposits upon the retina.

LAWFORD and COLLINS (520) collected 60 cases of glioma, of which 30 were males. In most cases the growth was observed before two years of age. Recurrence after operation did not take place within three years in 3 cases. The authors found 25 cases of recovery on record. In the fatal cases, where only one eye was affected, fourteen months was the longest duration of life, and three months where both eyes were involved. In 2 cases one eye shrank. Heredity was not present in any of the cases.

WERNER.

HILBERT (521) saw, during an attack of scintillating scotoma, an arterial retinal pulse extending beyond the margin of the papilla.

Both cases reported by JESSOP (524) were of optic atrophy. In one, tabes was the cause; in the other, a cerebral tumor. The pupils reacted promptly and simultaneously both to light and convergence. WERNER.

WILLBRAND'S (525) oscillating visual field is characterized by the test object along the same meridian at regular intervals appearing, disappearing, then coming again into view, and once more disappearing, and so on so that during the test fleeting scotomata cross various portions of the visual field. Such a field may be seen, though very rarely, in functional disturbances of the nervous system.

XIX.—OPTIC NERVE.

526. BERNHEIMER. A certain condition in the optic nerve. *Verhand. d. X. Internat. Med. Cong.*, vol. iv., 4, p. 148. (Atrophy as a result of atheroma of the ophthalmic artery.)

527. GURWITSCH. Hyaline formation in the optic papilla and retina in Bright's disease. *Centralbl. f. Augenhlkde.*, vol. xv., p. 225.

528. SAEMISCH. Communications from the Bonn Clinic. *Festschrift v. Helmholtz*, 1891.

529. KESSLER. Intra-vaginal fibrosarcoma of the optic nerve. *Weekbl. v. h. Nederland. Tijdsch. v. Geneeskunde*, part ii., p. 781, 1891.

530. SANTOS FERNANDEZ. Clinical note on alcoholic amblyopia during the Cuban war. *Soc. Opht. de Paris*, Nov. 3, 1891.

531. MANOLESCU. Massage of the optic nerve in certain cases of optic atrophy. *Rev. Med. Therapeut.*, June, 1891.

532. KALT. On the resection of the optic nerve as a substitute for the enucleation in sympathetic ophthalmia. *Clin. franç.*, Jan., 1891, p. 125.

533. MARCHAL. Comparison between resection of the optic nerve and enucleation in sympathetic ophthalmia. *Thesis of Nancy*, 1891.

534. TROUSSEAU. Concerning resection of the optic nerve. *Rec. d'Opht.*, 1891, p. 585.

535. COWELL. A case of acromegaly with atrophy of both optic nerves. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 34.

536. WEEKS. La Grippe as a cause of retrobulbar neuritis, and other ocular lesions. *N. Y. Med. Journ.*, August, 1891.

537. WEBSTER. A case of "choked disk" with unimpaired vision. *Amer. Journ. Ophth.*, Oct., 1891.

GURWITSCH (527) discovered in the papilla of a patient who had died of Bright's disease, and who had exhibited during life a neuro-retinitis, hyaline formations both in the lamina cribrosa and in the retina. The larger ones showed a concentric stratification.

SAEMISCH (528) delineates and describes (1) cases of congenital coloboma of the optic nerve, and (2) a case of chorio-retinitis striata.

KESSLER (529) reports the case of a five-years-old child with a tumor developing eighteen months previously behind the left eye, and pushing the globe forward. After a while the tumor was laid bare, by Snellen, and seemed to be situated in the muscular conus of the orbit. Later the optic nerve was divided with scissors at the foramen and the tumor removed. The partly fluctuating tumor lay in the dural sheath of the optic nerve which ran through it. The tumor proved to be a fibro-sarcoma consisting chiefly

of bundles of united spindle-shaped cells with interlying large plasma cells, and smaller sarcomatous. A few myxomatous cells were also discovered, but not in sufficient quantity to give the tumor any resemblance to a myxoma. WESTHOFF.

SANTOS FERNANDEZ (530) has had frequent opportunities of observing alcoholic amblyopia. The external halves of the optic papillæ were almost invariably atrophic. Tobacco had nothing to do with this condition, because, in his experience, Havana tobacco never produces amblyopia without producing some preliminary constitutional affection. In the discussion, Despagnet doubts if the outer halves of the papillæ were actually atrophic. In his opinion the pallid appearance is due to an arterial spasm produced by the alcohol. During the recovery from the alcoholic amblyopia the spasm disappears, and the pupil regains its normal appearance. MARCKWORT.

KALT (532) resected the optic nerve in a patient who suffered from constant and exhausting pain due to an irido-choroiditis of apparently spontaneous origin. The pain ceased at once, and a good recovery ensued. In Kalt's opinion resection of the optic nerve is just as safe a prophylaxis against sympathetic ophthalmia as enucleation, and, as an operation, to be preferred to the same.

MARCHAL (533) reports three cases of resection of the optic nerve. In two the indication was pain as a sequence of irido-choroiditis, and in the third incipient sympathetic ophthalmia. The results in all three cases were unfavorable. Marchal urges the abandonment of resection, and the immediate return to enucleation as the only safe prophylaxis in threatened sympathy.
MARCKWORT.

TROUSSEAU (534) reports the further condition of a patient in whom resection had been performed. A short time after performance of the resection of the nerve, sympathetic ophthalmia broke out in the good eye, and the enucleation caused rapid improvement, but unfortunately, as Trousseau now reports, the sympathetic inflammation later renewed its fatal effect, and the patient became nearly blind. MARCKWORT.

WEEKS (536) reports one case of retrobulbar neuritis from La Grippe, from his own practice, and 14 from other sources. In his own case there was a small central scotoma in both eyes with limitation of the color field. The disk was pale on the temporal side. S = R E $\frac{20}{200}$, L E $\frac{10}{200}$. The patient improved under tonics.
BURNETT.

WEBSTER (537) gives a case from Dr. Agnew's practice in which there was a marked papillitis in both eyes, and yet, with correction of a slight ametropia, the patient had normal vision. The cause of the papillitis was obscure. BURNETT.

XX.—INJURIES, FOREIGN BODIES (PARASITES).

538. BUNGE. Siderosis of the globe. *Verhand. d. X. Int. Med. Cong.*, 1890, vol. iv., 4, p. 151.

539. SALZMANN. Observation of the earlier developmental stages of a subretinal cysticercus. *Zehender's klin. Monatsbl.*, 1891, p. 302.

540. WAGENMANN. On the occurrence of giant cells and purulent exudation in the region of an intraocular cysticercus. *v. Graefe's Archiv*, vol. xxxvii., 3, p. 125.

541. DENTI. A very rare reflex pupillary phenomenon, due to tænia. *Boll. d. Poliambul. di Milano*, and *Boll. d'Ocul.*, vol. xiii., p. 17.

542. KOSTENITCH. Pathological investigations of gun-cap injuries of the human eye. *v. Graefe's Archiv*, vol. xxxvii., 4, p. 189.

543. CRITCHETT. Exceptional cases in ophthalmic practice. *Brit. Med. Journ.*, 1891, p. 1116.

By siderosis BUNGE (538) understands those cases mostly resulting from injury, in which the iron dissolved by carbonic acid in the globe is oxidized by the arterial hæmatinic acid, and precipitates itself into all portions of the eye, so that the latter assumes a nut-brown appearance, which is however not to be confounded with a hæmatogenous pigment. If we place sections of both sorts in a 5 per cent. solution of muriatic acid, the brown mass is within 24 hours completely dissolved from out the siderotic space, whilst it remains nearly unaltered in the hæmatogenously colored space.

SALZMANN (539) assumes that the parasite entered through the central artery. The region of the macula showed a slightly elevated opacification, and in the region of the fovea there was a whitish, rapidly moving body about ⅓ papilla diameter in size. The parasite increased five times in length within the next ten days, when a successful extraction was performed. The hooklets on the head were first observed on the 7th day.

WAGENMANN'S case (540) was not accompanied with tuberculosis, as was that reported by Schroeder, but it was a simple instance of giant cells and masses of suppuration produced by the exciting properties of the entozoön.

DENTI (541) observed in a woman of 51, who was under his care for an ordinary conjunctival catarrh, a bilateral and extreme myosis, which did not however cause much visual disturbance. Mydriatics were of no avail. The phenomenon was finally referred to the reflex influence of a tænia solium, for, when the latter was evacuated from the intestines by proper treatment, the pupillary reflexes at once disappeared, and did not return.

DANTONE.

KOSTENITCH (542) examined 20 eyes that had been injured with gun-caps, and found Leber's experimental investigations abundantly confirmed. A suppurative exudation produced by the action of the sulphate of copper, and without the action of microorganisms, entirely surrounded the foreign body. All of the internal coats of the eye, the nearer they lay to the foreign body, and the longer the latter had remained in the eye, were proportionally inflamed, and the greatest amount of inflammation was discovered in the site of the foreign body in the retina. The inflammatory process occasionally diminishes in amount, owing to a scale-like encapsulation of the deposit. The fibrillary alterations of the vitreous body which extend to the retinal detachment are especially worthy of observation. The retina degenerates or even occasionally necroses, owing to the chemical action of the copper. In the same manner the optic nerve becomes atrophic. In some cases the lens was purulently infiltrated, with thickening of the capsule, and increase of its cells. The absence of microorganisms in these eyes thus injured gives us the right to act conservatively, and to attempt operative removal of the foreign body.

CRITCHETT (543) cites a few cases of unusual injuries; superficial defects of the cornea produced by scratches, splinters of glass, and curling irons.

WERNER.

XXI.—OCULAR DISTURBANCES IN CONSTITUTIONAL AFFECTIONS.

544. ESKRIDGE. Gun-shot wound at the left cuneus, with right homonymous hemianopsia. *Med. News*, Oct. 17, 1891.

545. FARAVELLI. Right homonymous hemianopsia of traumatic origin. *Ann. di Ottal.*, vol. xx., 5, p. 431.

546. LEYDEN. Hemiopic pupillary reaction, the so-called Wernicke's iridoplegia. *Festschrift Virchow, Deutsch. med. Wochensch.*, 1892, No. 2.

547. HOCHE. Bilateral hemianopsia inferior and other sensory disturbances with a functional psychosis. *Arch. f. Psychiat. u. Nervenkrankheiten*, vol. xxii., 1, p. 70.

548. GROENOUW. Bilateral hemianopsia of central origin. *Ibid.*, vol. xxiii., 2, p. 139.

549. PETERS. Case of fracture of the skull with hemianopsia. *Deutsch. med. Wochensch.*, 1891, p. 1097.

550. SWANZY and WERNER. A case of double hemianopsia. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 183.

551. STORY. Temporal hemianopsia of the left and blindness of the right eye. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 297.

552. PRESTON. Two cases of homonymous hemianopsia. *N. Y. Med. Record*, July 4, 1891.

553. WILLIAMS. A case of horizontal hemianopsia. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 190.

554. WILLIAMS, R. A case of alexia. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 193.

555. ERB. On the etiology of tabes. *Berlin. klin. Wochensch.*, 1891, pp. 713 and 751.

556. NETTLESHIP. Cases of temporary blindness during lactation. *Royal London Ophth. Hosp. Rep.*, vol. xiii., p. 98.

557. KALT. Arterio-venous aneurism of the carotid in the cavernous sinus due to an injury. *Semaine Méd.*, 1891, No. 29, p. 236.

558. LOMBROSO. The visual field in epileptics and feeble-minded persons, according to Ottolenghi. *Rec. d'Opht.*, 1891, p. 449.

559. MAUTHNER. Polyencephalitis and sleep. *Wiener med. Wochensch.*, 1891, Nos. 26 and 27.

560. COHN. On nystagmus in ear affections. *Berlin. klin. Wochensch.*, 1891, pp. 1052 and 1074.

561. SEGGEL. The diseases of the eye in diabetes mellitus. *Münchener med. Wochensch.*, 1891, p. 754.

562. WEEKS. Influenza as the cause of retrobulbar neuritis and other ocular lesions. *N. Y. Med. Jour.*, vol. liv., No. 6.

563. MORTON. Bilateral paralysis of the external recti following diphtheria. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 107.

564. DEBOVE. Associated movements in facial paralysis. *Union Méd.*, 1891, No. 35, p. 421.

565. SNELL. Immediate loss of sight after injuries to head and back. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 137.

566. WHERRY. A case of paralgesia and ophthalmoplegia. *Trans. Ophth. Soc. Unit. Kingd.*, vol. xi., p. 118.

567. THOMPSON. Monocular diplopia. *Jour. Amer. Med. Assoc.*, Sept. 22, 1891.

568. BLISS. A curious case of vision dependent on the use of both eyes. *N. Y. Med. Record*, July 4, 1891.

569. DUNN. Four cases of reflex amblyopia. *Amer. Jour. Ophth.*, Oct., 1891.

The man of whom ESKRIDGE reports (544) was shot in the left occipital region an inch and a half anterior to the occipital protuberance, and half an inch to the left of the median line. The ball was extracted from about an inch below the cortical substance. There was typical right hemianopsia, but the movements of the eye were good. The pupil was slightly dilated and fundus normal. He died on the fifth day. The cuneus was found to have been completely destroyed. The ganglia and base of the brain and tentorium cerebelli were intact. BURNETT.

FARAVELLI (545) observed in a young man a right-sided sharply defined hemianopsia outward, originating after an injury on the head, lasting six weeks and then disappearing suddenly. As the eye remained with normal vision, and neither defects of speech nor sensorium were observed, the author thinks that the symptom originated in a small hemorrhage of the meninges of the left posterior occipital lobe, or in the cortical substance directly underneath, and the fibres running directly from the same. DANTONE.

LEYDEN (546) gives the clinical history of a woman who was submitted to an autopsy, after showing in life hemiopic iridoplegia after an apoplectic attack. Wernicke had deduced the theory that in such cases the interruption of the reflex paths must have occurred in front of the corpora quadrigemina, resp. in the tractus opticus. Corresponding then to this idea, there was found with the left-sided homonymous hemianopsia, in the right nucleus

lenticularis, a spindle-shaped softened deposit, which extended as far as the crus cerebri, and had partly attacked the tractus opticus.

HOCHE (547) examined a lying-in woman who had begun to suffer from melancholia previous to her delivery. The patient perceived irritating colored phenomena in the visual fields that are entirely abolished to most patients.

GROENOUW (548), after giving the history of sudden cases of blindness in both eyes due to disturbances of nutrition, mostly of an embolic nature in the posterior lobes, reports a new case of bilateral hemianopsia. A man of fifty-nine, with a slight apoplectic seizure in January, 1889, acquired a left-sided hemianopsia, and in November of the same year a right-sided hemianopsia. A small central spot remained unaffected, and vision was normal A portion of the missing fields gradually returned, and those that were absent were not amaurotic. Color sense unimpaired; sense of locality much affected. (In Schweigger's case of bilateral hemianopsia, which the reviewer had many opportunities of examining, the sense of locality was unimpaired.) The author concludes that, when a portion of the field is retained in bilateral hemianopsia of central origin, it generally embraces the points of fixation. The lesions of the sense of locality appearing in lesions of the occipital lobe, depend on the loss of a large number of optical remembrance-pictures.

PETER'S (549) patient, aged twenty-eight, suffered a fracture of the occipital regions with right hemianopsia when he was an infant. The peculiarity in the case is that in the course of years both the uncrossed and crossed fibres have become atrophic.

SWANZY and WERNER'S (550) patient had an apoplectic seizure which caused monoplegia of left arm, without loss of sensation. The whole of the right half of the field of vision was lost, and also the lower quarter of the left half, the defects being absolute. Ophthalmoscopic appearances normal. His condition remained unaltered for several months. The authors assumed that there was a double cortical lesion. WERNER.

STORY'S (551) patient, who was a young woman æt. nineteen years, was under observation for four years. The chief symptoms were absence of the menses, anæmia, pain in the head, increasing corpulence, and constipation. She always felt sleepy. The right eye was completely blind from optic atrophy. The left eye afterwards began to fail and to become atrophic. The visual field

taken at various times at first exhibited only slight temporal defect for red, subsequently a relative defect for white, which finally became absolute. WERNER.

Of PRESTON'S (552) cases. Case 1 was a man of fifty-one who seemed to be healthy except as to vision. There was right-sided homonymous hemianopsia and double optic neuritis. The treatment with the iodides was tried, but with no result. Patient died suddenly, probably from pressure on the medulla. Autopsy showed a spindle celled sarcoma involving the whole of the cuneus of the left occipital region, and encroaching somewhat on the precuneus. It involved all of the cortex as far as, and probably including, the angular gyrus. Case 2, man of forty-seven; specific history; marked arterio-sclerosis; complete right homonymous hemianopsia; disks pale; arteries and veins narrow. Provisional diagnosis: embolism of left posterior cerebral artery. BURNETT.

In WILLIAMS' (553) case there was a defect of the lower half of the left field and of the upper half of the right field of vision. There was some neuro-retinitis. The patient had some symptoms of ascending myelitis. WERNER.

WILLIAMS (554) reports the case of a man, æt. fifty-seven, who on receiving a letter found that he was unable to read it, although his sight was perfect. Vision $\frac{6}{6}$, and fundus normal. The fields exhibited a right-sided hemianopsia. He was able to write anything from dictation, but he could not read what he had written. He had no other symptoms, but said that his memory was defective. WERNER.

ERB (555) has made prolonged investigations into the subject, and concludes that syphilis is the most frequent and the most powerful cause of tabes, whilst other influences, like heredity, nervousness, cold, fatigue, excesses, overwork, and so on, rarely cause, by themselves alone, tabes, but often do so when combined with a syphilitic basis.

NETTLESHIP (556) records four cases of temporary failure of sight during lactation, in one of which appearances of post-optic neuritis were found many years after. In the remaining cases there were no ophthalmoscopic alterations. WERNER.

KALT (557) observed a case of aneurism of the carotid in the sinus cavernosus, owing to a fall on the occiput. A month later left-sided exophthalmus with immobility of this eye ensued. There was additionally knocking and blowing noises in the head.

Kalt ligated the common carotid without any after symptoms of any consequence, and the head symptoms at once ceased. The exophthalmus gradually disappeared in the course of a fortnight.

MARCKWORT.

OTTOLENGHI (558) examined a large number of cases at Lombroso's Insanity clinique and invariably discovered some field defect in lunatics or feeble-minded people. Partial inferior hemianopsia was often present in the right eye, and partial superior hemianopsia in the left eye. These defects were particularly well developed in the inner portions of the field. He also discovered the very rare homonymous vertical hemianopsia. The color field follows with greater or less regularity that for white.

MARCKWORT.

MAUTHNER (559) regards the sleep disease as a polyencephalitis superior. Slight ptosis is a frequent premonitory symptom. He places the seat of sleep in the central gray substance, and explains it by the interruption of the centripetal and centrifugal nerve conduction.

A nervous patient of COHN's (560), affected with middle-ear suppuration, suffered with typical attacks of violent nystagmus and vertigo, which could often be produced by pressure on the auricle, and especially upon the tragus. Cohn thought that this act might produce compression of the air in the meatus, and secondary irritation of the nervous elements. In opposition to the general theory of direct irritation of the brain in such cases, he is inclined to view with greater favor the idea of the reflex influences of the labyrinthine irritation or irritation of the semi-circular canals upon a portion of the ocular mobilization apparatus.

SEGGEL (561), like many others, does not consider every cataract in a diabetic as a diabetic cataract. He divides the retinitis in these cases, like Leber, into a central punctate and a hemorrhagic.

WEEKS (562) reports a case of retrobulbar neuritis after La Grippe, and adds a *résumé* of 14 others seen by various observers. In his own cases there was a small central scotoma in both eyes, with contraction of the field. Papillæ pale on temporal side. Vision, R $\frac{20}{200}$, L $\frac{10}{200}$. Tonics brought about recovery.

BURNETT.

MORTON (563) describes three cases of paralysis of the externi, appearing five, four, and seven weeks after the diphtheria. In one

case there was also paresis of the internus and superior. In all, the pupil reacted to light and convergence. The accommodation was affected in two cases. Loss of the patellar reflex in all three cases. A fourth case affected a child aged five years. In all of the cases the loss of the patellar reflex persisted long after all the other symptoms had disappeared. WERNER.

DEBOVE (564) observed a case of paralysis of the right facial nerve from a blow with a horse's hoof. It was very curious to note that the patient could only speak by shutting his eyes. Contrarily it was seen that the angles of the mouth rose when the eyes were energetically closed. MARCKWORT.

In SNELL'S (565) case the atrophy ensued upon a fracture of the skull. Although the sight was lost directly after the injury, the atrophy could not be determined till some weeks later.

WERNER.

WHERRY'S (566) patient was a gentleman æt. fifty-six, who had had syphilis twenty-five years before. Three days before, while at table, he noticed that everything tasted bitter, and he began to see double. Both pupils dilated and immovable. Divergent squint. No evidence of difficulty of accommodation. Patches of numbness of skin in the left thigh and left little finger. He recovered at the end of a month whilst taking iodide of potassium up to 110 grains daily. WERNER.

THOMPSON (567) reports a case of monocular diplopia in full, and from a study of this and some other recorded cases he concludes that monocular diplopia is, in the majority of cases, one of the symptoms of hysteria, provided that there is no defect in the refraction. When it occurs in connection with recent or former squint, it is a symptom of a psychical condition, closely related to hysteria, in which auto-suggestion is easily excited. When it occurs in connection with cranial troubles, it points to the posterior convolutions of the occipital lobe as the seat of the disease.

BURNETT.

In the case reported by BLISS (568) a girl æt. eight years had amaurosis, temporal hemianopsia, contracted field of vision, color-blindness, nyctalopia, and the vision of each eye separately was less than $\frac{1}{200}$; with atropine, and with both eyes together, with + 1.5 D, vision was $\frac{1}{40}$. [The probable explanation, in the opinion of the Reviewer, is that the hemianopsia condition (which is not reported in full) is at the bottom of the phenomenon. The two normal fields supplement one another when both

eyes are used. It would be interesting to have accurate drawings of the fields.] BURNETT.

DUNN'S (569) two first cases have been reported elsewhere. In the third case all uncertain amblyopia and some restriction of the field of the left eye, associated with paralysis of the facial on the left side, disappeared on curing an abscess of the root of the second molar of the inferior maxillary on the left side. In the fourth case, a man had a blow on the right cheek, just below the orbit. The nasal and buccal cavities became inflamed and ulcerated, the vision was much impaired, and there was slight ptosis of the right upper lid. The patient was lost sight of. BURNETT.

MISCELLANEOUS NOTES.

Dr. ST. BERNHEIMER has been appointed Lecturer on Ophthalmology at the University of Vienna, and settled in that city.

The following gentlemen have been appointed Lecturers on Ophthalmology, viz.: Dr. ALBERT PETERS, at Bonn; Dr. ELSCHNIG, at Graz (Austria); Dr. STÖWER, at Greifswald.

Dr. CZERMACK, of Vienna, has been appointed Extraordinary Professor of Ophthalmology at the University of Innsbruck; Dr. BERGMEISTER, Extraordinary Professor at Vienna.

Prof. ALFRED GRÄFE has resigned his chair at the University of Halle, on account of ill health. Prof. SCHMIDT-RIMPLER, of Göttingen, and Prof. VON HIPPEL, of Königsberg, were proposed, *æquo loco*, as his successors by the medical faculty. VON HIPPEL has been appointed by the Prussian government.

OBITUARY.

On June 20, 1892, after a long sickness, Dr. E. MARCKWORT, of Antwerp, died at Brunswick, Germany, in the house of his parents. We lose in him a tried collaborator, who distinguished himself by the exactness and truthfulness of his abstracts from French literature in our reports on the progress of ophthalmology.

ERRATA.

In this volume, page 178, 4th line from bottom and 4th from top, read "Ehrlich" for 'Ulrich."

On page 205, 2d line from top, omit words "he, as well as."

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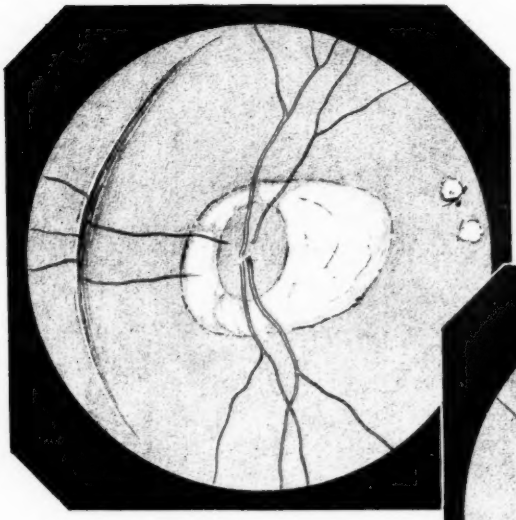

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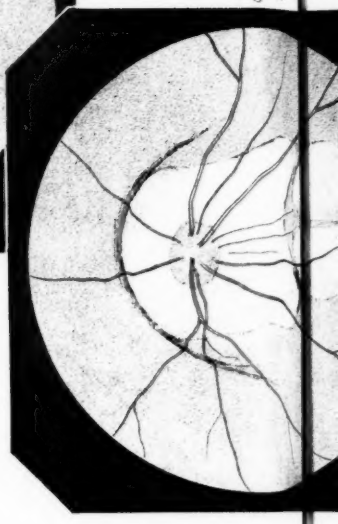

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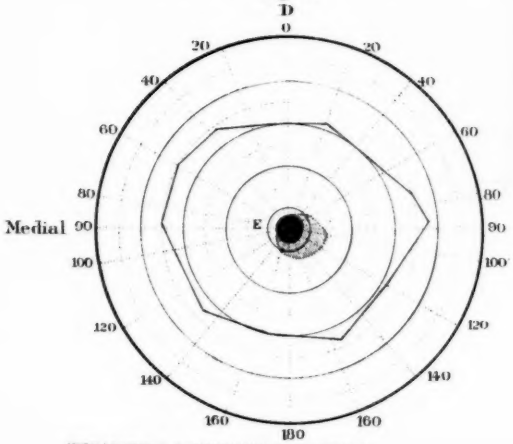

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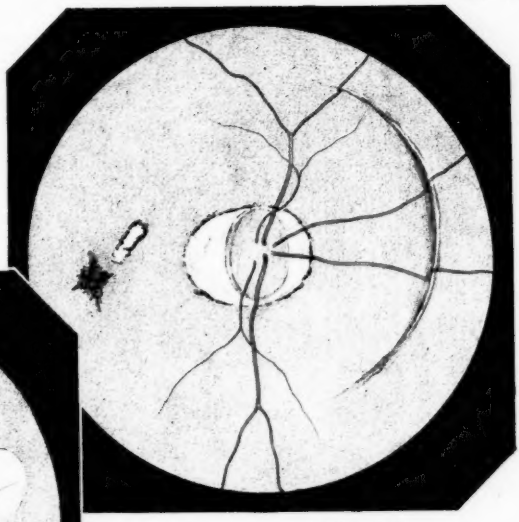

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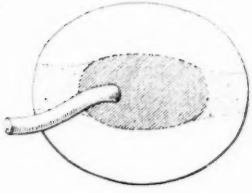

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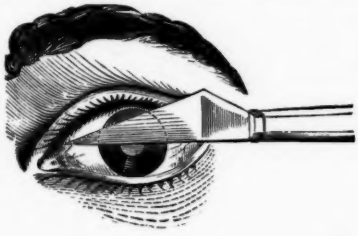

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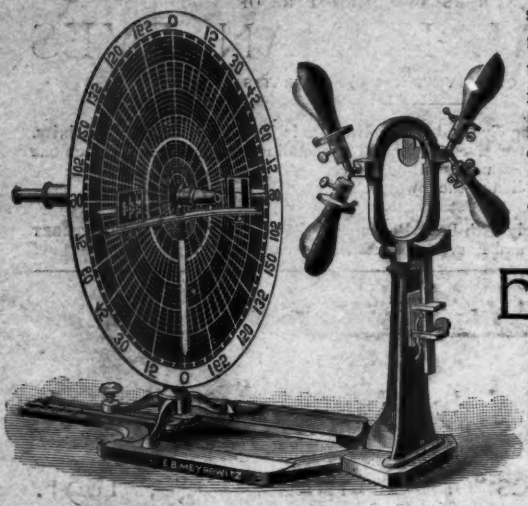

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